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Germany’s move to speed up coal plant closures meets backlash



Merkel and ministers from coal-mining states agreed to 2035 closures

Germany has agreed to close its coal fired plants three years earlier than planned but not all are happy with the decision. **Junior Isles**

Germany has bowed to public pressure, with its move to speed up its exit from coal fired generation. But the decision to close down the country’s coal fired plants earlier than originally scheduled has not been well received by environmentalists or coal fired generators.

Last month Chancellor Angela Merkel and ministers from the coal-mining states of Saxony-Anhalt, Saxony, North Rhine-Westphalia and Brandenburg agreed overnight a “shutdown plan” for the country’s coal plants. The scheme has been written into a draft law and is expected to be ratified by mid-2020.

With the announcement that plants would be closed by 2035, instead of 2038 as previously planned, “the exit

from coal begins now, and it is binding”, Environment Minister Svenja Schulze told reporters in Berlin.

The agreement also provides for an end to operating licences in the former Hambach forest (west), threatened by the extension of a lignite mine, which became the symbol of the fight against coal in Germany. RWE said more than half of its 2.1 billion tonnes of coal reserves would now remain buried.

The agreement is part of the country’s efforts to tackle the climate crisis, the government said. A plan agreed in December under pressure from anti-coal demonstrators calls for Germany to reduce output of greenhouse gases by 55 per cent compared with 1990s levels. The country has already admitted it will miss an intermediate target

for 2020 but the task of quitting coal has been complicated by Merkel’s decision to end nuclear power generation by 2022.

Eric Schweitzer, who heads the Association of German Chambers of Commerce and Industry, said a key question is how the electricity currently coming from coal fired power plants will be replaced. Schulze acknowledged that Germany will need a “massive expansion of wind and solar energy”.

The government said reviews will be carried out in 2026 and 2029 to determine whether Germany can exit coal fired electricity generation in 2035, three years before the final deadline.

Economy Minister Peter Altmaier,

said: “What we have here is a good agreement for climate protection because it makes clear that we mean it seriously.”

The Finance Minister, Olaf Scholz, said that the coal plant operators would receive €4.35 billion in compensation for switching them off early, with payouts spread out over the 15 years following the shutdown. The money will be on top of €40 billion that the government has already promised to coal-mining regions to soften the economic blow of abandoning the fossil fuel.

RWE is set to receive €2.6 billion of the compensation package, with the remaining €1.75 billion set aside for

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Renewables must double to advance energy transformation, says Irena

The share of renewables in global power should more than double by 2030 to advance the global energy transformation, achieve sustainable development goals and a pathway to climate safety, according to the International Renewable Energy Agency (Irena). Renewable electricity should supply 57 per cent of global power by the end of the decade, up from 26 per cent today.

A new booklet ‘10 Years: Progress to Action’, published for the 10th annual Assembly of Irena, charts recent global advances and outlines the measures still needed to scale up renewables. The agency’s data shows that annual renewable energy investment needs to double from around \$330 billion today, to close to \$750 billion to deploy renewable energy at the speed required.

Much of the needed investment can

be met by redirecting planned fossil fuel investment, said the report.

Close to \$10 trillion of non-renewables related energy investments are planned to 2030, risking stranded assets and increasing the likelihood of exceeding the world’s 1.5°C carbon budget this decade.

“We have entered the decade of renewable energy action, a period in which the energy system will transform at unparalleled speed,” said Irena Director-General Francesco La Camera. “To ensure this happens, we must urgently address the need for stronger enabling policies and a significant increase in investment over the next 10 years.”

According to Irena, additional investments bring significant external cost savings, including minimising significant losses caused by climate change as a result of inaction. Sav-

ings could amount to between \$1.6 trillion and \$3.7 trillion annually by 2030, three to seven times higher than investment costs for the energy transformation.

In January the Abu Dhabi Fund for Development (ADFD) approved the allocation of approximately \$105 million for eight renewable energy projects recommended by Irena. The projects recommended under the seventh cycle of the Irena/ADFD Project Facility, marks a record level of funding for any cycle since the facility was launched.

The facility supports developing countries in securing low-cost capital for renewable energy projects to increase energy access, improve livelihoods and advance sustainable development on the ground.

The new projects – in Antigua and Barbuda, Burkina Faso, Chad, Cuba,

the Maldives, Nepal, Saint Lucia and Saint Vincent and the Grenadines – bring the total to 32 projects and around 200 MW of new renewable energy capacity under the partnership.

All of the eight new projects are based on solar, with the exception of those in Antigua and Barbuda (hybrid solar and wind), the Maldives (waste-to-energy) and Nepal (biogas digesters).

Falling technology costs continue to strengthen the case for renewable energy. In its report, Irena points out that solar PV costs have fallen by almost 90 per cent over the last 10 years and onshore wind turbine prices have fallen by up half in that period.

By the end of this decade, solar PV and wind costs may consistently out-compete traditional energy. The two technologies could cover over a third of global power needs.

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utilities in eastern Germany. Rolf Martin Schmitz, RWE's Chief Executive, said the deal was acceptable but would stretch the group "to the limit".

The company said the early shutdown would impose financial costs of €3.5 billion, significantly more than the promised compensation. Some 3000 jobs are set to go at the energy firm "in the short term" and 6000 by 2030, mostly via early retirement, RWE added.

The timetable for plant closures calls for the first 300 MW unit to be taken out of service at the end of 2020, with another 900 MW due to go offline at the end of 2021. However, some of the biggest,



Schmitz: job cuts are planned as the deal will stretch RWE to the limit

most heavily polluting coal power stations will only be shut in 2028 and 2029.

The government's deal, however, does not include the newly built power station at Datteln, in western Germany, which has yet to start production. The plan, owned by Uniper, is claimed to be one of the cleanest and most efficient coal power stations in the world but was nonetheless supposed to be shut down. Now, it will be allowed to start production as planned.

News of the agreement, and of the planned opening of Datteln 4, was met with disappointment by some environmental campaigners. They criticised the decision, noting that the agreement will still mean a new coal fired plant goes online this year and allows for the expansion of the Garzweiler opencast mine in western Germany.

Olaf Bendt, Chairman of Germany's Bund environmental pressure group, said the government had pushed the bulk of power station closures back to beyond 2030, keeping some plants running longer than previously thought.

"Once again the government has shown that it has not understood the seriousness of the climate crisis," he said.

Ende Gelaende, a protest group that has organised multiple occupations of brown coal mines, tweeted: "Exiting coal is not a technical challenge, but a question of political will... 2035 is much too late!"

Greenpeace meanwhile, highlighted what it sees as the visible consequences of climate change.

"Australia's forests are burning, millions of people are demonstrating for climate protection and the German government is clearing the way for a new coal power plant," said Martin Kaiser, the Managing Director of Greenpeace Germany.

"Nothing shows more clearly than Datteln 4 that this government can't find an answer to the climate crisis.

"Chancellor [Angela] Merkel has missed a chance today to provide companies with long-term planning safety and to send a signal that Germany is reacting appropriately to the climate crisis."

Businesses show leadership in climate crisis

As US President Donald Trump dampened the spirits of climate activists while addressing climate issues at Davos, corporations showed that they are committed to a clean and sustainable energy future.

Junior Isles

While US President Donald Trump labelled climate activists as "perennial prophets of doom" during his address at last month's World Economic Forum in Davos, Switzerland, corporations continued to show that they view climate change as a serious threat.

In late January Bank of America Corp became the latest in a growing list of companies to make significant announcements along the road to achieving carbon neutrality. The company said it has become carbon neutral a year earlier than expected, by cutting CO₂ emissions, buying 100 per cent renewable power and purchasing carbon offsets. The claim is yet to be verified by a third party.

The bank said it has cut emissions by over 50 per cent in its facilities since 2010. It met its 100 per cent renewable power target by installing solar panels at many of its facilities, completing a number of long-term renewable agreements to add wind and solar power to the grid and also buying renewable energy credits. The company also bought carbon offsets from non-profit projects in deprived

areas across the US, South America, Africa and Asia.

"Being carbon neutral is core to our \$300 billion, 10-year environmental business initiative that is helping finance the transition to a low-carbon future," Bank of America CEO, Brian Moynihan, said.

Meanwhile, as part of the company's commitment to sustainability, Visa also announced that it reached its goal to use 100 per cent renewable electricity by 2020.

"At Visa, we see both a responsibility and an opportunity to make broad shifts toward a sustainable and inclusive future," noted Al Kelly, Chief Executive Officer of Visa Inc. "I'm proud of the investments we've made in our infrastructure to reach this important renewable energy milestone. We will continue to prioritise advancing the role of our business and industry in transitioning to a cleaner global economy."

At the same time Japanese carmaker Toyota Motor Corp. reported it successfully powered its European operations and facilities with 100 per cent renewable electricity in 2019.

In recent months, as public pressure has intensified, a host of companies

have promised to cut their carbon output. In September, Amazon pledged to reach net zero carbon emissions by 2040 and said 80 per cent of its energy would come from renewable sources by 2024.

The most headline-grabbing announcement, however, came from US software giant Microsoft. The company recently said it will become "carbon negative" by 2030 and offset all the carbon emissions it has made since it was founded. It also said it would launch a \$1 billion innovation fund to tackle the climate crisis with new carbon reduction, removal and storage technology.

Microsoft said emissions from its entire business and supply chain would halve by 2030 and that it will offset more than it emits. It set a target of 2050 to remove all the carbon it has emitted since it was founded in 1975.

Microsoft says it will work with suppliers and customers to help them reduce their carbon footprints, and will begin integrating carbon reduction into its procurement processes by July 2021.

In a blog post, Brad Smith, Microsoft's President, said: "If we don't curb emissions and temperatures

continue to climb, science tells us that the results will be catastrophic.

"Those of us who can afford to move faster and go further should do so," he added.

The pledge, however, might prove difficult to fulfil. Mathias Lelievre, CEO at Engie Impact, commented: "Microsoft's carbon negative strategy, as well as a similar recent announcement late last year from Ikea, demonstrates the continuing trend of large corporations seeking to make a step-change impact on climate.

"Companies are increasingly embracing the notion of sustainability transformation, but the challenge of achieving carbon reduction targets is highly complex – that's why according to Engie Impact analysis, only 25 per cent of companies are on pace to achieve their commitments.

"With a carbon negative strategy, even more radical sustainability transformation is required that touches every part of companies' business and ecosystem."

He said activities would have to expand "well beyond" making buildings more efficient, setting targets for suppliers and procuring renewable energy for company operations.

Sustainable financing hits record high

A new record was set in 2019 for the volume of sustainable debt issued globally in any one year, with the total hitting \$465 billion, up 78 per cent from \$261.4 billion in 2018.

Based on the latest figures of the comprehensive sustainable debt universe captured by research company BloombergNEF (BNEF), last year also saw all-time, cumulative issuance of sustainable debt smash through the \$1 trillion barrier, and reach \$1.17 trillion by December 31.

Jonas Rooze, lead sustainability

analyst at BNEF, said: "Our data show sustainable finance continuing to power ahead on a global basis. The steep increase is fuelled by end-investors' concerns about the threat of climate change, and the desire of many big company, bank and government leaders to be seen as behaving responsibly."

Sustainable debt covers a variety of instruments, from the well-established area of green bonds to the fast-emerging category of sustainability-linked loans. Green bonds, constituting more than half of the entire sustainable debt

market in 2019, saw \$271 billion issued – up from \$182 billion in 2018. Green bonds are securities with proceeds used entirely for environmentally friendly projects, like renewable generation or marine habitat conservation.

Some of the most spectacular growth of all is being seen in sustainability-linked loans, now the second most popular thematic debt type. This category, consisting of loans linked to the borrower's performance on defined environmental, social or governance (ESG) criteria, enjoyed a 168 per cent

jump in volumes to \$122 billion in 2019.

A new sustainability-linked bond category was introduced in the last half of 2019. Enel, the Italian utility company, issued the four inaugural bonds in this category in September and October. The coupons on these securities are tied to Enel's renewable energy generation goals. "This is another example of the creativity that has been a hallmark of the sustainability-themed debt market during its relatively short existence," commented Rooze.

European Commission unveils Sustainable Europe Investment Plan

The European Commission has unveiled its Sustainable Europe Investment Plan, the financial pillar of the European Green Deal.

The EU aims to mobilise €1 trillion in investments over the next 10 years to support the transition towards climate neutrality by 2050. Half of this amount will come from the EU budget, while Member States are expected to co-finance another €100 billion. The rest will come from private and public sources.

The European Investment Bank, the largest multilateral provider of climate finance worldwide will play a major role. It has already committed to increase its climate finance to 50 per cent of all its lending. It has also laid out a new energy-lending policy

to stop financing traditional fossil fuels and focus fully on energy efficiency, renewable energy and climate-friendly projects.

The Sustainable Europe Investment Plan builds on the success of the Juncker Plan (European Fund for Strategic Investment) and significantly expands on it.

The Sustainable Europe Investment Plan also includes a €100 billion Just Transition Mechanism to help fossil-fuel intensive regions transition towards sustainable technologies over the period 2021-2027. Such funding was demanded by Poland, Hungary, Estonia and the Czech Republic in order to support a EU proposal to reduce greenhouse gas emissions to net zero by 2050.

The Just Transition Mechanism will consist of three main sources of financing: the Just Transition Fund itself, which will receive €7.5 billion of fresh EU funds in the EU's next long-term budget; a dedicated just transition scheme under the InvestEU programme to mobilise up to €45 billion of investments; and a public sector loan facility with the European Investment Bank backed by the EU budget to mobilise between €25 and €30 billion of investments. It will be used for loans to the public sector, for instance for investments in district heating networks and renovation of buildings.

The Commission will put forward a legislative proposal to set this up in March. The goal is to have both the fund and the target approved by a

qualified majority vote of national governments – weighted by each country's population size – by the end of the year.

Meanwhile, renewables overtook fossil fuels as Europe's primary electricity source for the first time in 2019, according to energy market data analyst EnAppSys. The firm's latest report on the EU power market revealed that fossil fuels generated 941.3 TWh last year compared with the 1029.1 TWh produced by renewables and 777.0 TWh from nuclear plants.

Although overall levels of renewable generation dipped by 1 per cent in 2019, they have risen 24 per cent since 2015, outstripping the increases in fossil fuel generation (4 per cent) and nuclear generation (5 per cent) in the same period.

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Ørsted opens Rhode Island hub for offshore projects

■ Innovation Hub will underpin US activities ■ NY prepares port investment tender

Siân Crampsie

Investment in new infrastructure for the USA's nascent offshore wind energy sector is rising as developers prepare to start the build-out of the country's first large-scale projects.

Ørsted last month announced the opening of its new Innovation Hub in Providence, Rhode Island, while authorities in New York state are preparing to initiate a tender for port improvement projects.

Ørsted's Hub, which will officially open in the spring, is a key part of the supply chain for Ørsted, which has been awarded 2.9 GW of offshore

wind projects in the USA so far. Located at the CIC Providence workspace, the Hub will be the first point of contact for any US technology companies interested in contracting with Ørsted Offshore.

It will also seek to identify, foster, and finance enterprises related to offshore wind, with a focus on next-generation technology and related innovation in the offshore wind energy field, Ørsted said.

"Innovation has been the key to the success of the offshore wind industry in Europe, so committing time and resources to foster new technology growth here in the US was an obvious

step for Ørsted," said Thomas Broström, President for Ørsted North America and CEO of Ørsted US Offshore Wind.

"Locating this operation in Providence was an equally obvious move for us. The state has shown time and time again that it is home to one of the best innovation economies in the country and we look forward to becoming a part of that community," he added.

Ørsted operates the 30 MW, 5-unit Block Island wind farm in Rhode Island – the USA's first offshore wind farm – and is also developing the 700 MW Revolution Wind project in

Rhode Island in a 50-50 partnership with Eversource.

Last year the two developers were awarded the 880 MW Sunrise wind project in New York state alongside Equinor's 816 MW Empire Wind project. New York Governor Andrew Cuomo last month announced that the state would issue a second offshore wind tender in 2020, targeting at least 1 GW of capacity.

In a separate competitive process to be launched this year, NYSERDA, the Department of Transportation (DOT) and Empire State Development (ESD) will award \$200 million (€180 million) in public investments in port

infrastructure improvements to support offshore wind developments.

The three agencies launched a request for qualifications for the planned tender in late 2019 and received over ten proposals, according to Cuomo in his recent 'State of the State' address.

The awards will be structured to maximise the accompanying private investment and to attract the manufacturing, assembly, and maintenance of offshore wind equipment to New York, he added.

New York has set a goal of achieving 9 GW of offshore wind capacity by 2035, which is so far the most ambitious target set by a US state.

Brazil sees offshore wind horizon

Brazil could deploy as much as 700 GW of wind energy in offshore regions with water depths of 50 m or less, according to new analysis by EPE, the country's energy research agency.

In the 'Roadmap Eolica Offshore Brasil', EPE has identified barriers and challenges to the development of the offshore sector in Brazil, where around 9.5 GW of offshore capacity is in the early stages of development.

EPE says that more analysis is needed using meteorological data, as well as an assessment of potential restrictions for projects, such as environmental protection areas, commercial shipping routes, oil exploration areas and migratory routes of birds.

It also notes the lack of infrastructure and supply chain as potential barriers, as well as the need for an assessment of current planning and environmental regulations.

Offshore wind projects in Brazil's pipeline include the 310 MW Caucaia Parazinho project, the 400 MW Asa Branca I wind farm and the 5 MW, single-turbine Planta Piloto pilot wind farm off the coast of Rio Grande do Norte.

A further three 3 GW wind farms are in planning by Neoenergia, a subsidiary of Iberdrola in the states of Rio de Janeiro, Rio Grande do Sul and Ceará: Jangada, Maravilha and Aguas Claras.

Brazil does not currently have offshore wind-specific legislation and the Brazilian government last year began a consultation process in a first step to develop regulations.

■ Canada-based Solar Provider Group (SPG) is to invest \$250 million (€225.4 million) over the next five years in the Brazilian solar market. The company has formed a team to look for domestic development partners and corporate buyers of energy.

Mexico questions privatisation policy

Mexico's government could strengthen the state's role in the energy sector, overturning policies of the previous government on private participation.

President Andrés Manuel López Obrador has announced plans to end the "privatisation policy" in the country's electricity sector, which underwent reforms under the previous government of Enrique Peña Nieto to attract private investment.

In a speech during a visit to the Manzanillo thermoelectric plant in the western state of Colima, López Obrador said that the Federal Electricity Commission (CFE) would be "strengthened" to reduce the role of private participation.

The announcement came just days

after the *Financial Times* reported that CFE had drawn up plans to curb private investment by increasing transmission charges paid by independent power producers (IPPs).

A rise in costs would render many projects – renewables in particular – uneconomic, the *FT* reported.

López Obrador is a critic of the reforms implemented in 2013, which envisaged reducing CFE's market share in generation to 20 per cent. His government views the changes as a national security issue, and is also pursuing similar policies in the oil and gas sector.

CFE's market share now stands at around 54 per cent, with the remainder provided by private generators.

Coal slump cuts US emissions

■ Natural gas use rises
■ Coal plant closures continue



A sharp drop in coal consumption in the US last year helped US greenhouse gas emissions to fall by 2.1 per cent.

Research by the Rhodium Group indicates that coal fired electric power generation, which had rebounded slightly in 2018, fell by a record 18 per cent in 2019 to the lowest level since 1975.

However a rise in natural gas consumption in the US offset the emissions savings, resulting in the modest overall greenhouse gas emissions drop.

Emissions from transport remained relatively flat last year, while emissions from buildings, industry and other parts of the economy grew, Rhodium Group noted.

"All told, net US GHG emissions ended 2019 slightly higher than at the end of 2016," Rhodium Group said in a statement. "At roughly 12 per cent

below 2005 levels, the US is at risk of missing its Copenhagen Accord target of a 17 per cent reduction by the end of 2020, and is still a long way off from the 26-28 per cent reduction by 2025 pledged under the Paris Agreement."

The switch from coal to natural gas and renewables in the electric power sector accounts for the majority of the progress the US has made in reducing emissions over the past decade, Rhodium Group added. The drop in coal generation reduced emissions by 190 million metric tons in 2019. Meanwhile the growth in gas generation shaved a little more than 40 million metric tons off this number.

Overall, however, electric power sector emissions were still down by nearly ten per cent – the biggest year-on-year drop in decades, and a significant change from a 1.2 per cent

increase in 2018.

Recent analysis by *Reuters* indicates that coal fired power plants in the USA are closing at a near record rate, and that if the pace of closure continues, the USA will cut more coal capacity during President Trump's first term than it did during Obama's second term.

Using data from the US Energy Information Administration (EIA), *Reuters'* analysis found that power companies converted or retired around 15 100 MW of coal fired electricity generation in 2019.

It is the largest drop on record since the 19 300 MW that was shut down in 2015, during Barack Obama's presidency, and suggests that Trump's policies aimed at propping up the country's coal sector are struggling in the face of continued renewable energy growth.



Coal tax waiver could threaten clean energy growth

A carbon tax waiver on the production and import of coal in India could threaten the growth of renewables at a time when renewable energy auctions in the country are getting undersubscribed.

Syed Ali

The Indian government's proposed carbon tax waiver on coal could pose significant risk to the country's renewable energy sector growth.

At the end of last year Indian Prime Minister Narendra Modi's office proposed the waiver to help finance the installation of equipment to cut pollution from coal fired power plants, according to documents reviewed by *Reuters*. However, the move would also make coal plants more competitive with solar and wind energy.

Modi's office has proposed waiving the carbon tax of INR400 (\$5.61) per tonne that was levied on the production

and import of coal, according to the documents.

Commenting on the proposal Mohit Prasad, Project Manager at data and analytics company GlobalData, noted: "The power sector in India is mainly driven by the non-renewable energy sector with coal contributing more than 55 per cent of the country's installed capacity. The waiver in carbon tax is likely to have a negative impact on the growth of renewable energy. The coal-based power sector, which had witnessed cancellations of projects and competitions from renewable sources after the cost of renewables in India, fell below that of coal, and gas-based power will now regain momentum."

According to GlobalData, the annual installations of coal fired plants have dipped starting 2016 and the declining trend has continued till 2018. During the same period, however, solar PV installations have increased significantly, mainly driven by competitive auctions.

In January, the International Energy Agency praised India's progress in renewables. A report, released in partnership with NITI Aayog noted India's "strong progress" in providing, clean, secure and affordable energy to its citizens.

The report, the IEA's first in-depth review of India's energy policies, highlights the achievements of India's

energy policies and provides recommendations to support the government's goals of promoting well-functioning energy markets and boosting deployment of renewables.

The report highlights the strong growth of renewables in India, which now account for almost 23 per cent of the country's total installed capacity. The review also found that energy efficiency improvements in India avoided 15 per cent of additional energy demand, oil and gas imports, and air pollution as well as 300 million tonnes of CO₂ emissions between 2000 and 2018.

Fatih Birol, Executive Director of the IEA noted, however that "the energy

choices that India makes will be critical for Indian citizens as well as the future of the planet".

The waiving of the carbon tax on coal could prove to be a backward step in the country's progress.

Prasad warned: "The proposed waiver has been announced at a time when most of the renewable energy auctions in India are getting undersubscribed. The fall in tariffs under the auction mechanism has been putting pressure on the margins of project developers, thereby reducing the economic feasibility of project pipeline in the renewable energy sector. This is manifesting itself in the under-subscription of the auctions seen in recent times."



PLN eyes more renewables

- 1.5 GW to be added this year
- Agreement for ASEAN's biggest floating solar project

Syed Ali

State-owned electricity company PT Perusahaan Listrik Negara (PLN) has outlined a target to step-up the capacity of renewable energy-based power plants by 1.5 GW in 2020.

Currently, PLN's renewable energy-based power plant has a total capacity of 7.761 GW, and the country has outlined a target for renewable energy to account for 23 per cent of the country's energy mix by 2025. The Indonesian Renewable Energy Society (METI) estimates that renewable energy will contribute around 9 per cent to the energy mix in 2019.

To promote renewables growth, the Energy and Mineral Resources Ministry has prepared a new regulation on the purchase price for electricity from renewable energy-based power plant that will utilise the feed-in tariff scheme for its new price formula.

PLN's renewables ambitions received a boost last month with the

award of a contract to Abu Dhabi-based renewable energy company Masdar to build a \$129 million floating solar power plant at Cirata Dam, West Java.

In its first stage of development, the Cirata plant will have a capacity of 50 MW, PLN strategic procurement director Sripeni Inten Cahyani said, adding that PJB aims to increase the capacity to 145 MW by 2022.

Cahyani said: "After signing the PPA, we aim to reach a financial close within a year. So by early 2021, we can begin construction." She also said PLN would pay 5.8 cents/kWh for the plant's electricity.

PLN and Masdar signed a memorandum of understanding (MoU) to develop the Cirata plant in 2017. Initially the plant had an estimated potential capacity of 200 MW but PLN had to revise the MoU after the government abruptly changed a regulation over the appointment of power plant developers.

Egat forms technology venture with Ratch, Egco

The state-run Electricity Generating Authority of Thailand (Egat) is ready to expand its energy technology business by forming a joint venture with two subsidiaries: Ratch Group Plc and Electricity Generating Plc (Egco).

Egat governor Viboon Rerksirathai said the new firm has yet to be named, but Egat plans to own a 40 per cent stake of Baht600 million (\$19.4 million) in registered capital, while Ratch and Egco will hold a 30 per cent stake each. "The new joint venture is expected to be approved by the cabinet in June," said Mr Viboon.

The new energy technology company will focus on renewable resources, electric vehicles, energy storage, smart grids and efficient energy consumption

and will approach startups from InnoSpace (Thailand) Co, the government's venture capital company, for partnerships with private companies.

Earlier, Egat spun-off Egat International Co (EGATI) as a wholly-owned subsidiary for power generation to expand its business presence overseas.

In January Egat and PTT, the state-owned oil and gas company, were told to accelerate their investment plans both domestically and abroad to take advantage of the strong baht.

Energy Minister Sontirat Sontijirawong, said: "Roughly Baht36 billion (\$1.165 billion) from Egat and Baht100 billion from PTT have been allocated to beef up the country's economy in 2020," he said.

Egat has earmarked capital spending of Baht 600 billion over the next 10 years for power plants and transmission lines nationwide. Most of the large projects are gas fired power plants, while nine projects are floating solar farms at Egat's dams, which currently generate electricity from hydropower.

The move is in line with the latest national power development plan for 2018-37, which set a quota to increase power generating capacity by 5400 MW over the next decade while upgrading high voltage transmission lines.

Egat is in the first stage of floating solar development, with a 45 MW auction for a turnkey project with B. Grimm Power Plc at Sirindhorn dam.

Solar shift will help address increased energy demand

The Global Infrastructure Facility (GIF) working with the World Bank's Energy Global Practice, will help Vietnam to design and structure the Auction Program to transition from a feed-in tariff (FIT) regime to a sustainable competitive auction scheme for solar generation. This would be the first solar auction programme to be implemented in Vietnam.

Ousmane Dione, World Bank country director for Vietnam said GIF's support comes at a critical time to help the country overcome multiple remaining obstacles to further develop solar power, including financing and risk allocation.

Vietnam is actively seeking to attract private investment and use more public-private partnerships to address Vietnam's increased demand for energy. However, there is a need to adapt its current framework based on FITs to enable a competitive selection of independent power producers and minimise the cost of solar generation.

With the support of the World Bank and the GIF, the government is developing competitive bidding schemes to deploy utility-scale solar PV.

Vietnam has been gradually reducing its FIT as solar becomes more competitive.

The Ministry of Industry and Trade recently proposed a new FIT that is 32 per cent lower than the earlier incentive rate. It wants a fixed rate of 7.09 cents/kWh, down from the 9.35 cents offered to projects completed before 30 June last year.

The new tariff will apply to projects that kicked-off before 23 November last year and start commercial operations between July 2019 and the end of this year. Seven projects with a total capacity of 320 MW are so far eligible for the 7.09 cents rate, the ministry said.

The rate, however, will not be applicable in the central Ninh Thuan Province, a key location for solar power development, since another

plan has already been rolled out for projects with a capacity of under 2000 MW that begin commercial operations before 1 January 2021. The earlier FIT of 9.35 cents will continue to apply.

Vietnam's licensed solar capacity has already reached 25 000 MW, far exceeding the government's initial target to of 4000 MW by 2025.

While Vietnam's economic outlook remains robust, with a forecast of 6.5 per cent growth in 2020 and 2021, it faces many challenges in meeting its infrastructure needs, particularly in the energy sector, which faces growing demand.

■ The People's Committee of Bac Lieu province on 21 January 2020 granted an investment decision to Singapore's Delta Offshore Energy Pte.Ltd (DOE) to build a 3200 MW liquefied natural gas fired power plant. The project, worth approximately \$4 billion, is the biggest foreign direct investment project in the Mekong Delta region.



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Europe News



Poland pushes on with offshore wind regulations

■ Offshore tenders scheduled for 2025-2028 ■ Onshore wind distance rule examined

Advanced stage offshore wind projects in Poland could be awarded fixed-price contracts for difference (CFDs) under proposed new regulations published by the government last month.

The Ministry of State Assets has released much anticipated draft legislation for the offshore wind energy sector, confirming plans to allow build-ready wind farms to proceed with CFDs negotiated with the government before opening a series of competitive tenders for other, less developed offshore wind farms in the pipeline.

According to the rules, up to 4.6 GW of capacity could be awarded 25-year fixed-price CFD contracts by 2022, enabling early projects to start producing power in 2024 or 2025. If this process results in contracts for less than 4.1 GW, the 500 MW-plus of remaining capacity will be auctioned in 2023.

Further auctions are planned for 2025 (2.5 GW) and 2027 (2.5 GW). If the capacity cap in the 2027 auction is not met, another auction will be held in 2028.

The regulations will help Poland to

meet its target of developing 8 GW of offshore wind energy in the Baltic Sea by 2035. Its plans have drawn a number of international investors to the market, including Ørsted, Equinor and EnBW.

The published regulations are open for consultation until mid-February.

Among Poland's most advanced offshore projects are the up to 840 MW Bałtyk II and 600 MW Bałtyk III wind farms being developed by an Equinor-Polenergia joint venture. The two wind farms have environmental permits and connection agreements and could obtain a final building

permit this year.

Last month the Polish government also announced plans to review legislation affecting the onshore wind energy sector.

Onshore wind developers are currently restricted by the so-called '10-H' distance regulation, which prevents them placing turbines closer to buildings than distances equivalent to ten times their tip height.

The regulation means that 99 per cent of Poland's land territory is excluded from new project development, according to PSEW, Poland's

Wind Energy Association. It also prevents permitted, construction-ready wind farm projects from revising their designs to use the most modern wind turbine designs.

The government says it will look at revising the legislation, which will also affect wind farm refurbishment projects planning to use taller, more modern turbines in place of existing, older units.

PSEW says that the regulation could stay in place and amended to allow local authorities to exclude designated areas from the rule.

Terna utilises storage to drive grid overhaul

Italian grid company Terna is overhauling the country's electricity network with the help of innovative storage technologies.

The company has awarded a new round of contracts under its pilot Virtually Aggregated Mixed Units (UVAM) project, which uses small-scale units to provide grid services.

The UVAM project has been operating since 2018 and now uses over 120

small-scale storage units across the country to provide ancillary services such as grid balancing, congestion resolution and tertiary reserve. The units total around 830 MW, according to Terna.

In the latest UVAM round, Enel X has been awarded contracts to aggregate residential energy storage units, enabling private residents to participate in demand management

programmes in Italy for the first time.

Marco Gazzino, Enel X's Head of Innovation and Product Lab, commented: "The potential of this experimentation is enormous: there are thousands of residential batteries in Italy that will help ensure the stability of the power system. This is a milestone for the country on its path towards an increasingly sustainable energy model."

The trial, which will finish at the end of 2020, includes more than 100 photovoltaic systems with storage. Enel X acts as the aggregator and controls the units remotely to provide grid balancing services on demand.

The UVAM initiative is part of Terna's Grid Development Plan, which aims to enable the connection of 40 GW of new renewable energy capacity by 2030.

■ UK energy company, Centrica, and battery specialist Sonnen have completed a project to aggregate a network of 100 domestic energy storage batteries to provide dynamic firm frequency response (DFRR) services to the GB grid. The two companies say that the storage units include batteries and hot water tanks, and claim that the project is the UK's largest virtual power plant.

New UK wind schemes buck downward trend

■ EDF, Vattenfall projects could add 187 MW
■ RenewableUK calls for new onshore wind policy

Siân Crampsie

New onshore wind energy schemes are being proposed in the UK, offering the industry a glimmer of hope in the absence of government support for the technology.

EDF Renewables last month put forward proposals for an up to 22 turbine wind project in Powys, while Vattenfall confirmed it would seek planning permission for a 14-unit extension to its existing Clashindarroch wind farm in Aberdeenshire, Scotland.

Government support for onshore wind farms closed in Great Britain in 2018, leading industry group RenewableUK to call on the government for a new strategy to be put in place.

Its data shows that the UK wind sector delivered just 629 MW of onshore wind in 2019 and 651 MW in 2018, down from a record high of 2683 MW

in 2017. Of the 23 projects that started generating in 2019, 22 had qualified for government-backed financial support under the Renewables Obligation, FiT or CFD schemes that are now closed for onshore wind.

Just two onshore wind projects – three turbines totalling 1.9 MW – received planning approval in England in 2019 and just one new project was submitted into the English planning system, with a capacity of 5 MW. No projects were approved or submitted in Wales last year, according to RenewableUK.

"These figures highlight that the current approach is falling short on delivering renewable energy capacity at the level needed for net zero," said RenewableUK's Head of Policy and Regulation Rebecca Williams. "This is a flashing red warning light on our net zero dashboard and we urgently need a new

strategy from government.

"Onshore wind is one of the cheapest low carbon technologies in the UK, quick to build, and it's hugely popular as the government's own opinion polls show 78 per cent of people support it ... We need to see new policies which support the full range of clean power sources to transform our energy system."

EDF's 110 MW Garn Fach proposal includes installation of up to 22 turbines with 150 m-high tip heights to the south of Newtown. It has carried out a number of ecological and other feasibility surveys and has submitted an environmental scoping report to the Welsh Government. It plans to submit a planning application at the end of 2020. Vattenfall wants to add 77 MW to the grid at Clashindarroch II, near Huntly. The 6 MW wind turbines would have 180 m tip heights.

Estonia starts offshore permits process



The Estonian government has initiated the construction permit procedure for three offshore wind farms, indicating its commitment to developing the technology as part of plans to meet clean energy targets.

The three projects are located in the Gulf of Riga and have a capacity of almost 1.4 GW. The start of the construction permit process also marks the start of the environmental impact assessments for the projects.

The wind farms include Eesti Energia's 1 GW project proposal and a 380 MW project proposed by Tuuletraal OÜ.

A third project put forward by Baltic Workboats AS is a 4 MW near shore wind farm.

Eesti Energia wants to install up to 160 wind turbines in the Gulf of Riga and has already carried out primary wind measurements, seabed, ice, and bird surveys. The project could be online in 2030 and could account for up to half of the country's power demand, Eesti Energia said.

Tuuletraal's wind farm would comprise up to 76 turbines in combination with aquaculture infrastructure installed in an area covering 88 km² off Pärnu County.

Baltic Workboat's project is proposed in a 2 km² area near Nasva harbour, 200 m from the coast.

Estonia and Latvia are also in talks over the joint development of offshore wind capacity in the Gulf of Riga.

Saudi Arabia launches NREP third round

Saudi Arabia will add 1200 MW of solar PV capacity to its grid following the third round of its National Renewable Energy Programme (NREP).

The country's Renewable Energy Project Development Office (REPDO) has released a request for quali-

fications (RfQ) for the installation of four large-scale solar power projects, with a deadline of 6 February 2020 for bid submission.

The four projects on offer are the 80 MW Layla project, the 120 MW Wadi Al Dawaser solar farm, the

300 MW Saad project and the 700 MW Ar Rass scheme. The tender rules include a local content requirement of at least 17 per cent.

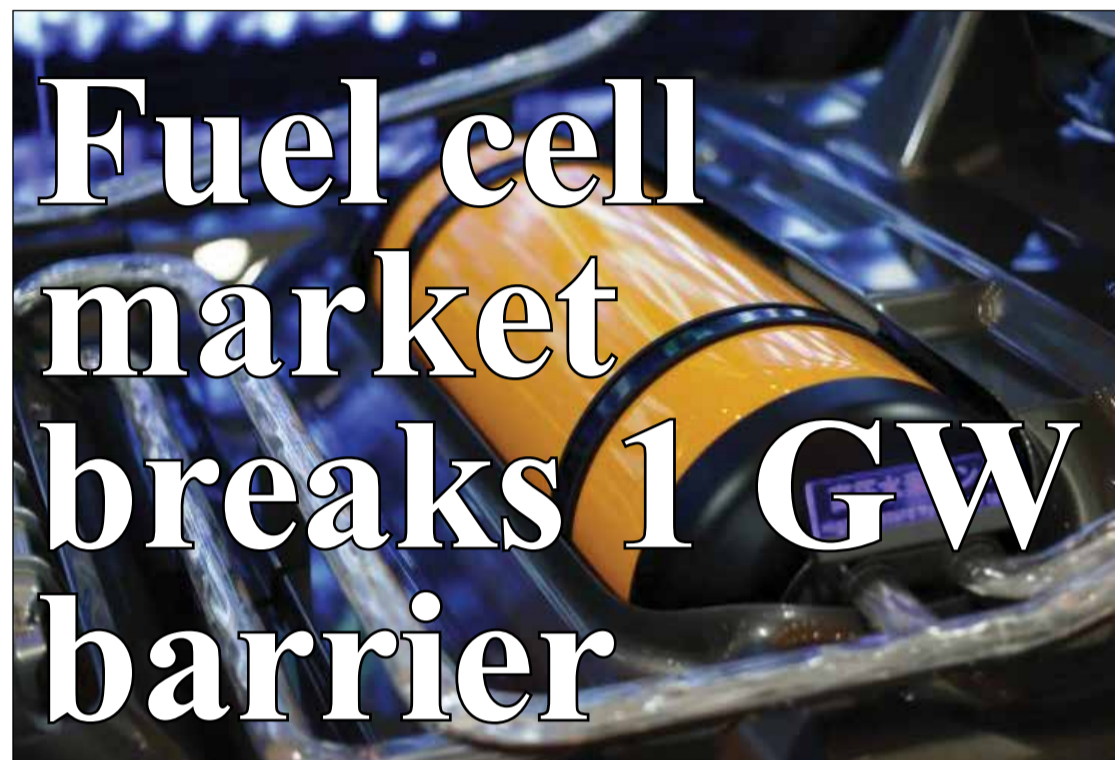
The second round of the NREP was launched in mid-2019 and is due to close in February too. That round seeks

to award 1470 MW of solar capacity from six projects.

The first round of the programme facilitated the installation of the 300 MW Sakaka solar park and the 400 MW Dumat Al Jandal wind farm, which is still under construction.

Saudi Arabia's NREP was launched in 2017 with the goal of boosting the share of renewables in the country's energy mix.

It has set a target of 27.3 GW of renewables capacity by 2024 and 58.7 GW by 2030.



The global hydrogen fuel cell market shipped around 1.1 GW of capacity in 2019 – a 40 per cent rise over the previous year, according to a recent report.

E4tech's 'Fuel Cell Industry Review' says that last year was the first that the industry broke the 1 GW barrier, driven largely by demand for fuel cell vehicles from Japan's Toyota and South Korea's Hyundai.

Between them, these two companies account for two thirds of 2019's shipped fuel cell capacity, and when combined with the burgeoning bus, truck and van markets, account for over 900 MW of the 1.1 GW total. The remainder consists of stationary systems – of which US and Korean power generation units make up the bulk – and tens of thousands of Japanese CHP units installed in apartments.

"There is a real sense that the industry is on the cusp of something great,"

said David Hart, Director, Fuel Cells & Hydrogen at E4tech. "Fuel cells are proven from a technical perspective, and blowing past the 1 GW mark is a vindication of that. Now, as we enter a new decade, the sector also enters a new stage, which will be characterised by rapid commercialisation and infrastructure build out.

"If the 2010s can be seen as the break-out decade for the battery, the 2020s will see the ascendancy of the fuel cell. Just in time, too: climate change targets are looking more urgent and challenging than ever, and we need a full range of technologies to meet them."

Asia remains the largest market for fuel cells, accounting for 680 MW, driven strongly by Hyundai NEXO sales into Korea and by Korean stationary power. Fuel cell vehicles deployed in Asia in 2019, including trucks and buses in China, constitute 50 per cent of the total shipped fuel

cell capacity worldwide.

The NEXO also accounts for some growth in European capacity, which rose from 41 MW to 69 MW in 2019. However, the biggest market outside of Asia is North America, which saw shipped capacity of 384 MW – down slightly from 425 MW in 2018, but expected to rebound in 2020.

Hart added: "To succeed, the fuel cell industry will need to see the supply chain mature quickly enough to deliver on expectations, and to allay any remaining safety concerns. But the opportunity is huge, big players are investing very seriously in hydrogen, putting the pieces into place to make it work.

"Once that happens, fuel cells will rank as an established technology, feeding not just into the success of today's products and systems, but featuring in the designs of tomorrow's innovators and entrepreneurs."

Mubadala deal boost Uzbek capacity

Mubadala Investment Company, the sovereign fund of the United Arab Emirates (UAE), and its subsidiary, Masdar, will add new renewable energy and thermal power generating capacity to Uzbekistan's grid to help the country meet rapidly rising electricity demand.

Mubadala has signed an agreement under which Masdar will design, finance, build and operate a 400 MW, \$600 million wind farm in Uzbekistan's Navoi region. Construction is expected to start in the third quarter of 2020, and commercial operation in 2022.

According to Uzbekistan's Investment and Foreign Trade Ministry, Mubadala has also signed a deal to purchase existing thermal power generating units and construct new capacity at the Talimarjan thermal power plant in the Kashkadarya region of Uzbekistan.

The first 800 MW unit at Talimarjan was commissioned in 2004. A feasibility study is currently underway for construction of two new combined cycle units by 2022.

The deal follows a 2019 agreement with Masdar on the construction of a

photovoltaic power station with a total capacity of 100 MW in the Navoi region following a competitive tender for the project.

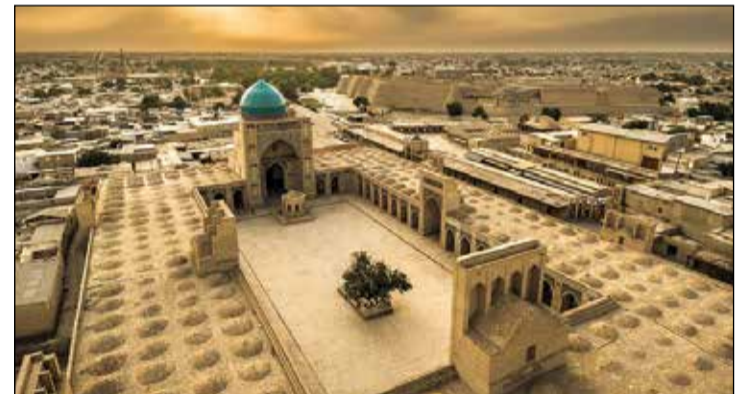
Masdar won the tender with a bid to supply solar power at \$0.027/kWh and committed to build a 100 MW plant in the Navoi region in Western Uzbekistan within 12 months.

Electricity demand in Uzbekistan is set to grow at around 10 per cent in 2020, according to the government, which has made electricity sector investment a priority.

Last month Masdar also sealed a deal with Azerbaijan's Ministry of Energy to develop and finance a 200 MW solar photovoltaic (PV) project.

Under the agreement, Masdar will develop, build and operate the 200 MW solar PV project, which will be located 75 km southwest of the capital, Baku. Financial close on the project is targeted for the end of 2020, while commercial operations are expected to start in 2022.

Azerbaijan's Ministry of Energy has also signed a power purchase agreement with ACWA Power to develop, build and operate a 240 MW wind power project.



Abu Dhabi explores hydrogen society

Abu Dhabi will investigate the economic and technical feasibility of creating a hydrogen-based society.

The emirate's Department of Energy (DOE) has signed a memorandum of understanding with Japan's Marubeni to collaborate on the use of hydrogen and on the efficient use of electricity and water.

Under the MOU, both parties will jointly implement research, development, and proofs of concept, as well as share their respective expertise and know-how in the areas of renewable energy, hydrogen production, supply and distribution, and investigate whether hydrogen production from renewable energy is technically and commercially viable.

The Abu Dhabi DOE was established in February 2018 to drive the future direction and provisioning of the emirate's energy sector in all its forms and to create an efficient system that enables economic growth, energy security and sustainable development.

It has recognised the potential for hydrogen to provide a stable, long term source of green energy and says that the creation of a hydrogen supply chain is "highly sought after".

Abu Dhabi's first nuclear power plant is expected to begin operations within the next few months, according to the DOE. The first of four units at the Barakah plant was due to come on line in late 2017 but has been delayed several times.

Energy access key to unlocking Africa's potential

A new report says that improving energy access across Africa with off-grid and mini-grid technologies will help to transform the continent's rural areas.

In 'Energized: Policy innovation to power the transformation of Africa's agriculture and food system', experts from the Malabo Montpellier Panel highlight the lack of energy access and the impact this has on rural regions.

It says that mini- and nano-solutions can be instrumental in helping small-holder farmers to meet rising food demand as well as improve access to

education and health facilities. It also indicates that Africa has an opportunity to use innovative, clean technologies to 'leapfrog' older, polluting energy technologies and develop sustainably.

Africa accounts for just six per cent of the world's energy demand, despite hosting 20 per cent of the global population. However, achieving universal energy access will require a four-fold increase in investment to \$120 billion a year by 2040, the report says.

Notably, the report identified several

countries that have made significant progress in improving access to energy. These include Ethiopia, where access to electricity doubled between 2010 and 2016, and South Africa, where government policy targeted installation of off-grid electrification schemes for 300 000 rural households.

Ghana also has one of the highest rates of electrification in sub-Saharan Africa, thanks in part to its Self-Help Electrification Programme as well as the Energising Development (EnDev) partnership.

Ocean coalition aims to accelerate offshore wind

A new global partnership has been created by energy giants Ørsted and Equinor in a bid to help accelerate the growth of offshore wind and other ocean renewable energy technologies.

The Ocean Renewable Energy Action Coalition says it will bring together industrial groups with civil society and intergovernmental institutions to prepare a pathway to 2050 for ocean energy technologies as well as represent the sector in the global dialogue on climate action.

The coalition's members include CWind, Global Marine Group, JERA, MHI Vestas, Mainstream Renewable Power, Shell, Siemens Gamesa, TenneT and The Crown Estate.

According to a report published by the Expert Group of the High-Level Panel for a Sustainable Ocean Economy, ocean based renewables such as offshore wind, floating solar, tidal and wave power, could account for almost ten per cent of the annual greenhouse gas emissions reductions needed by 2050 to keep global temperatures at less than 1.5°C above pre-industrial levels. Most of this climate change mitigation potential is expected to come from offshore wind.

"If we're serious about fighting the climate crisis, it's vital we decarbonise the world's energy use as quickly as possible through technologies like offshore wind," said Benj Sykes, Vice President at Ørsted. "The Ocean Renewable Energy Action Coalition will work together to accelerate the opportunity presented by ocean renewables to achieve the Paris Agreement goals."

Stephen Bull, Senior Vice President for Wind and Low Carbon at Equinor,

said: "Collaboration between nations and companies is needed to accelerate the sustainable deployment of ocean renewable energy. This Action Coalition includes leading industry players in offshore wind and we are working together to unleash the full potential of offshore wind globally."

The Action Coalition was formed in response to the September 2019 Call for Ocean-Based Climate Action made by the High-Level Panel for a Sustainable Ocean Economy, with ad-

ditional partners including Global Wind Energy Council and the UN Global Compact.

It will devise a vision for 2050, highlighting the actions that industry, financiers and governments can take to sustainably scale-up offshore wind, and thereby contribute to the UN Sustainable Development Goals and global decarbonisation goals.

Initial outputs will be announced at the UN Ocean Conference in Lisbon in June 2020.



- Masdar targets Iberia with Cepsa
- EDF, Masdar boost Abu Dhabi buildings efficiency

Siân Crampsie

UAE firm Masdar is extending its global reach with new international joint ventures targeting renewable energy in Europe, the Middle East and Africa.

The company has signed an agreement with France's EDF to establish a company offering energy efficiency and distributed solar energy services in Abu Dhabi, and has also established a joint venture with Spain's Cepsa to develop renewable energy projects in the Iberian Peninsula.

In a third deal, Masdar and Egypt's Infinity Energy have announced plans to develop utility-scale solar energy and wind power projects in Egypt and Africa.

Masdar and EDF's new joint venture will leverage the support of their respective subsidiaries, including Dalkia, EDF ENR, EDF Renewables and Citelum, to provide solutions such as Energy Performance Contracts.

The company will help tackle the "significant challenge" of reducing building and industry-related emissions, and support Abu Dhabi's 2030 energy efficiency strategy, Masdar CEO Mohamed Jameel Al Ramahi said.

In Europe, Masdar and Cepsa have established a 50:50 joint venture called Cepsa Masdar Renewables that will focus on developing wind power and solar photovoltaic projects with an initial target of 500 to 600 MW in Spain and Portugal.

Renewables accounted for more than half of Portugal's electricity demand in 2019, with the country targeting

80 per cent clean power by 2030. Spain is looking to reach 74 per cent electricity generation from clean power sources by the end of the decade.

"The Iberian Peninsula is an attractive location for renewable energy investors and we look forward to expanding our renewable energy portfolio further into the region, while strengthening our partnership with Cepsa," Al Ramahi said in a statement.

Last month Masdar announced an agreement with renewable energy firm Infinity Energy to take advantage of renewable energy opportunities in Egypt and Africa.

The joint venture – Infinity Power – "will bolster the progress Egypt has made in renewable energy and catalyse further development in the region", Al Ramahi said.

Infinity Energy currently operates six solar plants with a total capacity of 235 MWp, and is the leading renewable energy developer in Egypt. "Infinity Power will also extend its commitment to our home continent – Africa," said Mohamed Elamin Ismail Mansour, Managing Director and co-founder at Infinity Energy. "We believe in Africa's large growth potential in the power sector and we look forward to implementing renewable energy generation projects where they are needed, and to seeing the positive impacts of these projects on the local communities where they are located."

The European Bank for Reconstruction and Development recently committed an investment in Infinity Energy of up to \$60 million in the form of capital increase to finance the development of renewable energy projects.



Rolls-Royce has increased its holding in energy storage specialist Qinous in a bid to broaden its reach and boost its microgrid offering.

The engineering firm says it is acquiring the shareholdings of other current financial investors in Qinous to take its holding to 73.1 per cent.

The details of the transaction have not been disclosed but will give Rolls-Royce a broad range of battery storage options and enable it to pool all of its microgrid activities operating under its Power Systems Division.

Rolls-Royce had already acquired a 19.9 per cent stake in Berlin-based Qinous as a start-up back in October 2018. The company is involved in battery storage systems and associated control systems, and has already implemented storage solutions around the world.

Qinous will become the competence

centre for microgrid solutions within Rolls' Power Systems division, with its founding shareholders continuing to hold shares in the company and retaining their current roles, Rolls-Royce said.

"Our new subsidiary is to play a pivotal role going forward," said Andreas Schell, CEO of Rolls-Royce Power Systems Division. "This is where we are going to pool all the division's microgrid activities – from simple storage solutions to complete, complex microgrid solutions of various sizes and configurations."

"As a young, start-up-style company, Qinous brings expertise that is an ideal complement to Rolls-Royce's industrial credentials."

According to Schell, the two companies have been working jointly on storage technology development and believe they can "achieve new market

potential by integrating more closely. We see great market potential for sustainable power supplies, especially for distributed, environmentally-friendly MTU microgrid solutions."

Qinous specialises in modular, scalable, prefabricated plug-and-play battery products that combine renewable energy sources, power generators and battery storage technology.

"This even closer partnership between Rolls-Royce and Qinous is a logical and consistent step towards opening up the rapidly growing microgrid market," said Steffen Heinrich, co-founder and co-managing director of Qinous.

"The functionality and reliability of the solutions have been proven in a large number of projects. Now, with MTU's experience and global presence, we can meet demand more quickly and more comprehensively."

SGRE expands with Senvion deal

Siemens Gamesa Renewable Energy (SGRE) has expanded its geographical reach in the lucrative wind turbine services market with the completion of a deal to buy part of its insolvent German rival, Senvion.

SGRE announced in January that it had sealed the €200 million deal, acquiring large parts of Senvion's services business across 13 European countries and securing around 2000 jobs.

It called the move "transformational" because it will strengthen its competitive position in Europe with the addition of around 9 GW of serviced capacity.

The deal also includes Senvion's intellectual property. "This has been a

unique opportunity for consolidation, a win for all parties and a perfect match for Siemens Gamesa," said SGRE CEO Markus Tacke. "By integrating these assets and highly skilled professionals we will improve our position as a leading global service partner at a crucial moment for the wind industry's growth."

"The transaction also offers Senvion's customers a long-term solution for their servicing needs, following Senvion's insolvency."

"This acquisition is an important part of our strategy to grow our multi-brand service business. Now that we've successfully closed the transaction, we will focus on the integration and ensuring that operations continue

smoothly," said Mark Albenze, CEO of Siemens Gamesa's Service business. "By acquiring all relevant know-how and IP to access the SCADA and controller software, technical knowledge on spare parts supply and Senvion's remote control centre, we are well positioned to offer competitive service solutions to all of Senvion's customers worldwide," he added.

Senvion went into administration in 2019 and says that the deal with SGRE will save around 60 per cent of its workforce.

The company had struggled financially in the competitive wind energy market faced with falling levels of government support and lower energy prices.

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Americas

NYPA orders hydro upgrade

Burns & McDonnell will serve as the engineering, procurement and construction (EPC) contractor for a \$134 million electrical control system upgrade and modernisation project at the New York Power Authority's 2525 MW Robert Moses Niagara hydropower plant.

Burns & McDonnell will work with Emerson to implement the upgrade, which is part of a \$1.1 billion programme to extend the life of the hydropower plant. Emerson will provide its Ovation automation system as well as associated configuration and commissioning services.

The project will be implemented in a phased approach and started in late 2019.

Wärtsilä brings Bahamian plant on line

Wärtsilä has signed a two-year operation and maintenance (O&M) agreement with the Bahamas Power and Light Company Ltd (BPL) for a 132 MW power plant that it recently completed in the Bahamas.

Wärtsilä will train and develop the owner's Bahamian work force for managing the new technology, while also providing key performance guarantees.

The Clifton Pier Station A power plant project was awarded to Wärtsilä in December 2018 on an engineering, procurement, and construction (EPC) contract. The plant was urgently needed to replace an ageing facility, and to improve the reliability of the local grid. Wärtsilä delivered the new plant on a fast-track basis in just 12 months.

The New Providence-based plant's output is generated by seven Wärtsilä 50 engines, running on heavy fuel. Its engines can play an effective balancing role, ensuring system stability to offset the inevitable fluctuations in supply from wind and solar sources.

Expert Microsystems gets DOE support

The US Department of Energy (DOE) has awarded funding to Expert Microsystems to develop technology to improve operations at coal fired power plants.

Expert Microsystems will lead a project to develop, demonstrate, and commercialise a novel approach to improve coal fired power plants' ability to follow loads and handle transient behaviour by integrating two proven real-time monitoring techniques.

"The future role of coal plants will depend on the ability to cycle power output and follow loads to meet marginal power demands, accommodate renewables and support the grid," commented Randy Bickford President & CTO of Expert Microsystems.

The hybrid analytics approach provides a single solution that integrates an established, advanced data-driven analytics solution that includes artificial intelligence, advanced pattern recognition, and machine-learning techniques provided by Expert Microsystems with a well-proven, first-principle thermal heat balance model solution provided by MapEx Software Inc.

XMPLR Energy is also supporting the project.

SGRE selected for Dominion offshore wind

Siemens Gamesa Renewable Energy (SGRE) has been named as the

preferred turbine supplier for the 2640 MW Dominion Energy Virginia offshore wind project in the USA.

The wind farm is the largest US offshore wind farm in development to date. Dominion is expecting to complete turbine installation off the coast of Virginia by 2026 but has yet to determine the final number of units and exact turbine model.

The agreement is subject to certain conditions including Dominion Energy's final investment decision, governmental permitting, and other required approvals, SGRE said. It will also include a long term service and maintenance agreement.

Dominion Energy Virginia Offshore Wind will expand on knowledge gained through the current two-turbine, 12 MW Coastal Virginia Offshore Wind (CVOW) project. It is the first offshore wind project to be built in US Federal waters and will utilise SGRE's 6 MW SWT-6.0-154 wind turbines.

CVOW is set to be online in 2020 within a research lease area adjacent to the site where the 2640 MW project will be located.

Asia-Pacific

Wärtsilä supports ASEAN grid

Wärtsilä has signed an engineering, procurement and construction (EPC) contract for a new 100 MW/100 MWh energy storage project in an unnamed location in South East Asia.

The new facility will use Wärtsilä's GEMS energy management software and will provide grid support services. It will enable the transition towards the greater use of renewables in the region by boosting grid reliability, Wärtsilä said.

Egat to build floating solar

A Chinese consortium has signed a deal to build the world's largest floating solar hybrid power project.

BGRIM Power Energy China, a consortium of B Grimm Power Plc (BGRIM) and China Energy Engineering Group Shanxi Electric Power Engineering Co Ltd. (Energy China) has signed an engineering, procurement and construction (EPC) contract with the Electricity Generating Authority of Thailand (Egat) to build the project at the Sirindhorn Dam.

BGRIM will install a 45 MW solar power plant on the water surface of the Sirindhorn reservoir and combine it with the output of existing hydropower capacity at the site. The project will help to create a synergy between solar and hydropower and is an important step in the development of renewable energy in Thailand, according to Egat Director Gen Somsak Rungsita.

The solar project is set to start operating at the end of 2020.

JinkoSolar powers 150 MW in Cambodia

JinkoSolar Holding has signed deals to deliver 150 MW of photovoltaic (PV) panels for three projects in Cambodia.

JinkoSolar will supply panels for one 60 MW and one 30 MW PV park in Krakor district, in Cambodia's Pursat province. The third plant, with a capacity of 60 MW, will be located in the central province of Kampong Chhnang.

The solar farms are part of government efforts to increase renewable energy generation in Cambodia, where electricity demand is set to grow from 1.5 GW currently to 2.3 GW by 2020 and 2.8 GW by 2021.

Europe

BWSC wins Belgium contract

BWSC has entered into a Technology Supply contract and a 15-year O&M contract for Gentse Warmte Centrale (GWC), a 20 MWe biomass power plant located in Ghent, Belgium.

BWSC will design and supply GWC's biomass feeding system, the biomass fired boiler and the flue gas treatment system. Belgian Eco Energy (BEE) is the developer of the project.

Elecnor, based in Bilbao, Spain, is the turnkey contractor for the plant. The construction period is scheduled for 25 months with the plant expected to be operational early 2022.

DNV to monitor Núñez de Balboa

Iberdrola has selected DNV GL's GreenPowerMonitor (GPM) solution to monitor the 500 MW Núñez De Balboa solar power plant in Spain.

The solar farm is the largest under construction in Europe and is due to start operating in the first quarter of 2020. The plant will be monitored with GPM SCADA management, which allows control of each individual device in the solar plant.

The Núñez de Balboa solar project is the biggest photovoltaic plant monitored by DNV GL's GPM. It joins a portfolio of over 4000 solar and wind facilities that produce more than 29 GW of clean energy around the globe.

DNV GL acquired GreenPowerMonitor in June 2016.

Nordex adds 172 MW to the Netherlands

Nordex has won a contract in the Netherlands to equip the De Drentse Mouden en Oostermoer wind farm.

The manufacturer will supply 44 of its N131/3900 turbines including the foundations with a total capacity of 171.6 MW to Duurzame Energieproductie Exloermond BV, Raedthuys DDM B.V. and Windpark Oostermoer Exploitatie B.V., who are jointly developing the project, located in Groningen.

Nordex will also be providing service for all these turbines after installation on the basis of a Premium Service contract for a period of 25 years. The turbine delivery and installation will start from the second half of 2020.

Equinor commits to zero CO₂

Norwegian energy giant Equinor has announced plans to cut absolute greenhouse gas emissions from its offshore and onshore operations to near zero by 2050.

Under the plan Equinor is aiming to reduce emissions from its Norwegian operations by 40 per cent by 2030 and 70 per cent by 2040, requiring annual cuts of more than 5 million tonnes.

It will achieve the targets through large scale industrial measures, including energy efficiency, digitalisation and the launch of several electrification projects at key fields and plants, including the Troll and Oseberg offshore fields and the Hammerfest LNG plant.

"We plan investments in the order of 50 billion Norwegian kroner (\$5.46 billion) together with our partners by 2030 to cut emissions in order to strengthen the long-term competitiveness for our fields and plants," said Eldar Sætre, CEO of Equinor. "In setting these ambitions

Equinor has assumed stable framework conditions and necessary investments in the electricity grid."

International

Total and Marubeni to build Qatar PV plant

Japan's Marubeni and French energy major Total are to build an 800 MW solar photovoltaic (PV) plant in Qatar.

Marubeni announced it has signed a 25-year power purchase agreement (PPA) with Qatar General Electricity and Water Corporation (Kahramaa) for the output of the Al Kharsaah Solar PV independent power project. It will own a 20.4 per cent stake in the project, while Total will own 19.6 per cent.

Qatar Petroleum and Qatar Electricity & Water Company (QEWC) will own the remaining 60 per cent of the project.

Engie and Nareva win bid for Gafsa

The Tunisian Ministry of Mines and Energy and STEG has selected a consortium led by Engie and Nareva as the preferred bidder for constructing the Gafsa photovoltaic power plant in Tunisia.

The consortium will develop, design, finance, build, operate and maintain the 120 MWp plant, which will be one of the first solar IPPs in Tunisia and part of the country's renewable energy sector development programme.

The project is the first collaboration between Engie and Nareva in Tunisia. The two companies have previously jointly developed the 300 MW Tarfaya wind farm located in Morocco.

SNC-Lavalin to assess Cernavoda 1

SNC-Lavalin's Candu Energy has been awarded a \$10.8 million contract by Societatea Nationala Nuclearelectrica (SNN) for engineering analyses and assessments on the Cernavoda Unit 1 nuclear reactor in Romania.

Under the contract, Candu Energy will focus on the fuel channel and feeder assemblies of the plant, with the objective of extending its operating life by around four years, or up to 245 000 effective full power hours (EFPH).

The work will enable the plant to continue operating safely until it is ready for refurbishment in 2026.

Cernavoda 1 produces over 700 MW of electricity, about 10 per cent of Romania's electricity demand. It was commissioned and began commercial full power operation in December 1996.

Israel opts for GE HA technology

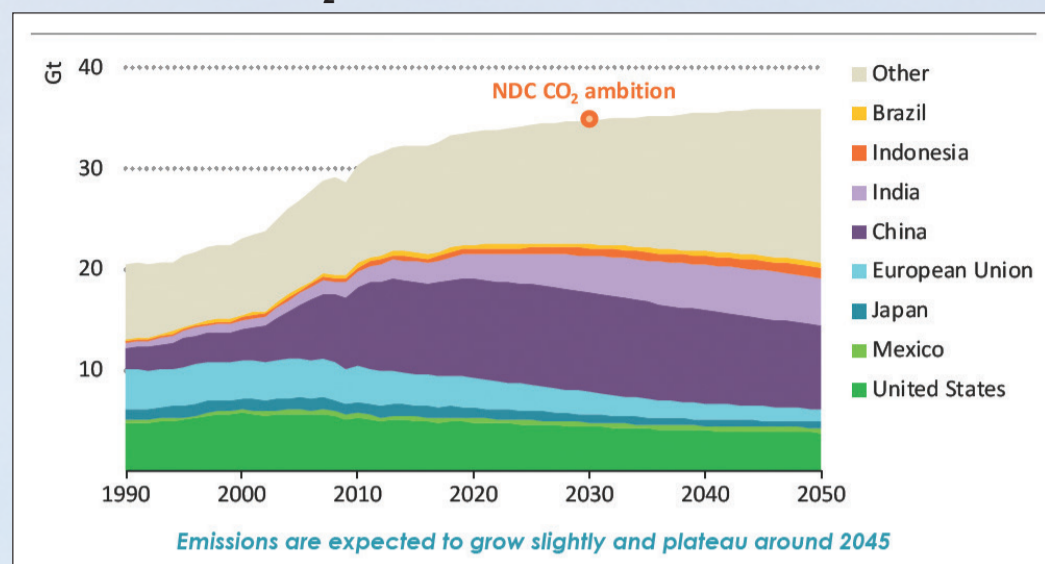
GE has received a second order from the Israel Electric Corporation (IEC) for a 9HA.01 heavy-duty gas turbine for the Orot Rabin plant, located in Hadera, Israel.

The unit will be installed at the Orot Rabin power plant, which is being converted from coal to gas firing. For the conversion, GE will also provide a steam turbine, generator, heat recovery steam generator and balance of plant equipment – as well as a 15-year multi-year services agreement.

Once operational, the Orot Rabin combined cycle gas turbines are expected to be the largest and most efficient gas fired power units in the country, delivering up to 1260 MW, i.e. more than eight per cent of Israel's current total power generation capacity.



Energy-related CO₂ emissions by region in the Stated Policies Scenario

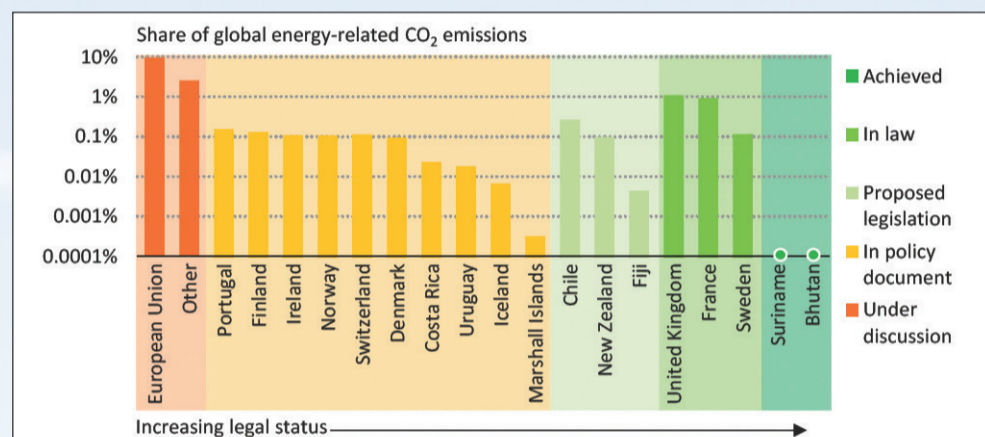


Note: NDC = Nationally Determined Contribution.

World Energy Outlook 2019, © IEA/OECD, Figure 2.12, page 96

For more information, please contact:
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 website: www.iea.org

Net-zero carbon or GHG emissions reduction announcements



More than 65 jurisdictions accounting for 13% of global CO₂ emissions have announced net-zero CO₂ or GHG emissions commitments for 2050

Notes: The other category includes countries not shown that have recently signalled their intent to put forward net-zero targets (UNFCCC, 2019a). The 13% total share of emissions covers all jurisdictions in the figure, without double counting. Under discussion category means that consultations to develop a net-zero target are ongoing. The policy document category means that a net-zero target has been put forward, however, without legally binding status. The proposed legislation category means that the target has been proposed to parliament to be voted into law. The In law category means that a net-zero target has been approved by parliament and is legally binding. The achieved category means that the jurisdiction absorbs more CO₂ than it emits, e.g. through afforestation. Not included in the figure are the efforts of some state and local entities, such as California, though they would increase the share of emissions covered to over 16%.

World Energy Outlook 2019, © IEA/OECD, Figure 2.14, page 99

Annual CO₂ emissions from the power sector by scenario (Mt)

	Stated Policies						Sustainable Development	
	2000	2018	2025	2030	2035	2040	2030	2040
Electricity generation	8 247	12 655	12 608	12 643	12 703	12 759	7 544	3 129
Coal	5 920	9 357	9 262	9 263	9 175	9 048	4 665	1 323
Natural gas	1 341	2 656	2 770	2 897	3 099	3 330	2 594	1 732
Oil	986	641	575	483	429	381	285	168
Bioenergy with CCUS	-	-	-	-	-	-	-1	-94
Heat production	1 055	1 163	1 151	1 135	1 110	1 075	916	651
Coal	532	708	679	657	627	593	461	228
Natural gas	415	403	426	435	443	445	415	391
Oil	108	51	45	43	40	37	40	32
Total	9 302	13 818	13 759	13 777	13 813	13 834	8 460	3 780
CO ₂ captured with CCUS	-	1	1	14	37	59	309	1 323

Note: Mt = million tonnes; CCUS = carbon capture, utilisation and storage equipment.

World Energy Outlook 2019, © IEA/OECD, Table 6.5, page 275

Start of Israel gas exports to Egypt and Jordan signals future role for East Mediterranean

The export of Israeli natural gas to Egypt and Jordan will boost gas use in the region, particularly for power generation in Egypt.

Gary Lakes

The export of Israeli natural gas to Egypt and Jordan at the start of this year is a significant step towards the East Mediterranean becoming an important source of energy not only for the immediate region, but also for Europe and possibly other markets.

During the 2020s countries in the East Mediterranean region and also in Southeast and Central Europe can expect to see a number of advances through the coming exploitation and distribution of natural gas produced in the East Mediterranean. Besides new exploration that will take place in Cyprus, Israel, Egypt and hopefully Lebanon, these regions will also benefit from the development of gas infrastructure that is just beginning to take shape. Along the way, natural gas will undoubtedly take on a larger role as the main source of power generation in these countries.

It has taken 10 years for Israel's Leviathan field to come on-stream and find its first markets. During that time the whole region has been through a transformation brought on by the Arab Spring that erupted in 2011. The revolution in Egypt has had an important impact on energy developments in the East Mediterranean. Egypt went from

a gas exporter to gas importer and is now a gas exporter again. Furthermore, Egypt intends to establish itself as a regional gas hub and it has set up the East Mediterranean Gas Forum, whose founding members include neighbouring countries that have pledged to cooperate in developing the regional gas industry.

Most of the Israeli gas market is now supplied by the Tamar field, which came on-stream in March 2013. The 10 tcf field was rushed into production by operator Noble Energy when shipments of gas from Egypt stopped in 2012. The question for Noble and its partner Delek Drilling was how to monetize the Leviathan field, with a resource of 22 tcf, and the nearby Aphrodite field in the Cyprus offshore that it discovered in December 2011, a year after finding Leviathan.

The availability of gas is expected to boost demand in Israel, which will now be met by Leviathan or by the Karish and Tanin fields that are under development by Greece's Energean Oil & Gas.

Changes in Egypt's political system opened the way for Israeli gas. Egyptian gas exports to Jordan had also stopped, which as with Israel, created serious problems for power generation. Both countries were forced to turn to expensive liquid fuels for energy. Years of talks led to a small amount of Tamar gas first being delivered to the

Jordan Bromine Company and the Arab Potash Company in January 2019 following the construction of a short pipeline. Those companies will take 3 bcm in total over a period of 15 years at a cost of up to \$700 million.

As of January 1, this year, shipments of Leviathan gas were delivered to the Jordan National Electric Power Company (NEPCO). It will receive 45 bcm over a 15-year period at a cost of some \$10 billion. Jordanian officials have said the deal will save Jordan some \$500 million annually. But despite the fact that gas from Israel is cheaper than any other source of fuel, there is widespread political opposition to the deal in Jordan, where a significant part of the population is of Palestinian origin. Jordan's Lower House of Parliament in mid-January passed a draft law banning the import of Israeli gas into the country. However, it is unlikely Jordan will break the agreement.

Political opposition to importing Israeli gas also exists in Egypt, but Cairo has a wider plan that involves Israeli gas, and Cypriot gas too for that matter. Leviathan gas deliveries began in mid-January through the refurbished East Mediterranean Gas (EMG) pipeline, which previously delivered Egyptian gas to Israel. The EMG runs offshore between the cities of Ashdod and Al Arish.

Noble and its partners in Leviathan

have a contract with Egypt's Dolphus Holdings to supply some 85 bcm of gas over 15 years at a cost of around \$19 billion. Dolphus will supply the gas to Egyptian industry. This will provide those industries with natural gas that they will use for power generation and feedstock that at times in the past was in short supply from the Egyptian gas authorities.

Some of this gas to Dolphus will inevitably find its way to Egypt's power stations and also at one of Egypt's two LNG plants, both of which stopped operations for several years due to a shortage of gas for export.

Egypt's gas production hit a low of 4.5 bcm/year in the period following the revolution, forcing a halt to exports and the import of LNG through two FSRUs anchored in the Red Sea. Meanwhile, Egypt's 7.2 million tons/year capacity LNG facility at Idku, and the 5 million tons/year plant at Damietta were idle.

The government of President Abdel Fattah el-Sisi has introduced a number of reforms to the Egyptian energy sector that has resulted in significant change. Steps have been taken that encourage foreign investment in exploration. Contracts have been renegotiated, with better terms and prices offered to foreign partners. Legal changes have made a big difference, as well as ending energy subsidies. Egyptian Petroleum Minister Tarek El Molla recently stated that since 2014 Egypt has signed 79 exploration and production licenses. That translates into hundreds of millions of dollars of investment and a busy upstream, midstream and downstream.

Egypt can now meet domestic gas demand and has resumed LNG exports and exports to Jordan via the Arab Gas Pipeline at a rate of as much as 350 million cubic feet per day.

A positive jolt for Egypt was the discovery of the Zohr gas field by Eni in 2015. The field has a resource of 30 tcf and was rushed into production. Sometime this year, its output will reach 3.2 billion cubic feet per day and Egyptian gas output will average 7.5 bcf/d. Meanwhile, more gas fields offshore and onshore Egypt are being developed.

As more gas becomes available in Egypt, much will be used to keep up with growing electricity demand for Egypt's expanding population. In 2018, Siemens commissioned three mega-plants, each with a generating capacity of 4.8 GW. More power generation facilities are on the drawing board. Furthermore, Egypt is exporting electricity to Jordan, Libya and Sudan, and plans a 3 GW connection with Saudi Arabia.

The Idku LNG plant is operating at full capacity and shipped 50 cargoes in 2019. Idku is operated by Shell, one of the shareholders in the Cyprus Aphrodite field, where the resource is around 4.5 tcf. Late last year the Cypriot government approved a development plan for Aphrodite with operator

Noble and partners Delek and Shell. Talks are now ongoing for a commercial agreement that will deliver Aphrodite gas to Idku by subsea pipeline for re-export as LNG beginning by 2025. Meanwhile, the Damietta plant is due to reopen this year.

There remains a lot of gas in Israel available for export and more to be discovered in the region. Israel has awarded new blocks for exploration and Athens-based Energean is proposing to sell Karish gas to Cyprus delivered by pipeline, but Cyprus is already pursuing a project to install a FSRU and import LNG, which will allow it at last to switch off liquid fuels and power the island with cleaner natural gas.

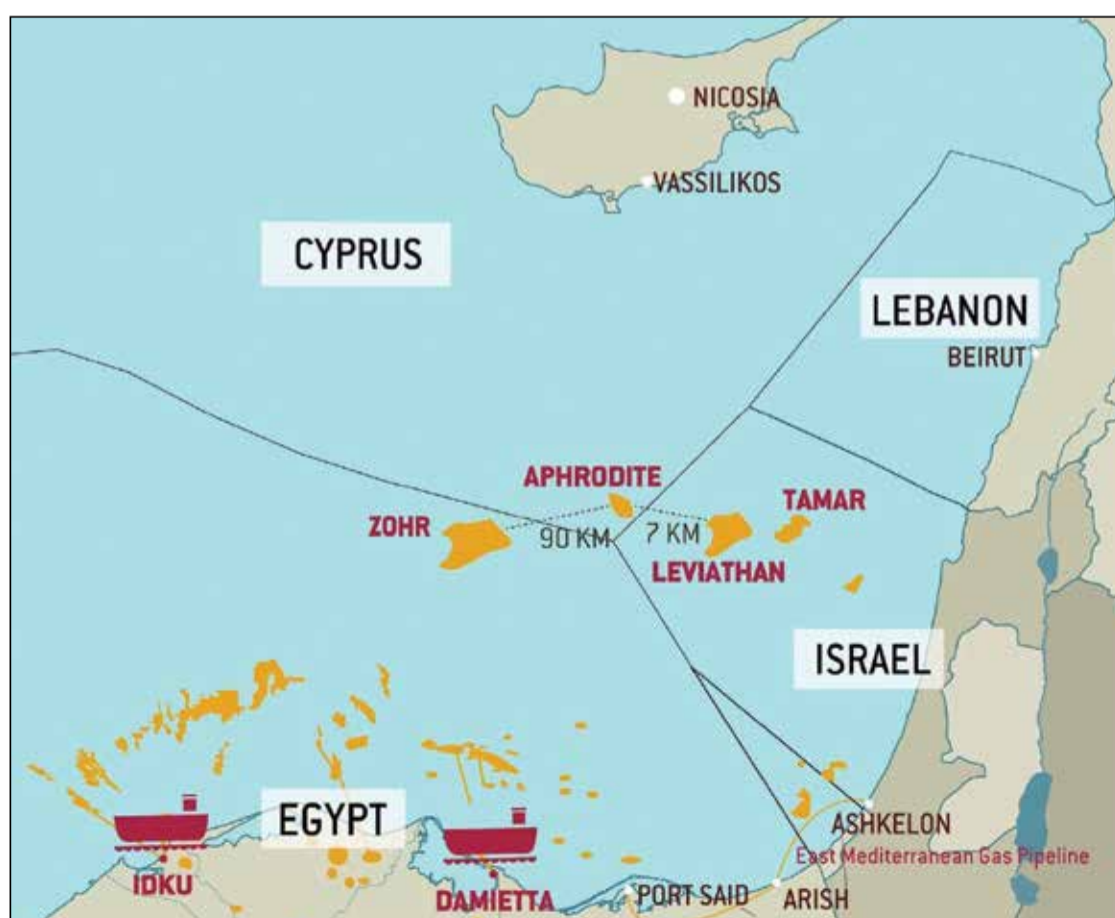
Cyprus is hoping to see as many as 10 wells drilled in its offshore over the next two years, but it is being thwarted by Turkey, which claims much of the island's exclusive economic zone (EEZ) and threatens companies exploring offshore Cyprus with warships. Turkey is creating a serious problem in the East Mediterranean, not only for Cyprus, but for Israel, Greece and Egypt as well, all of whom are members of the East Mediterranean Gas Forum, which also includes Jordan, the Palestinian Authority and Italy. France and the US have applied to become members of the EMGF, and the membership is open to other countries, they only need to abide by good neighbourliness and international law.

Israel, Greece and Cyprus have reached political agreement on the EastMed Gas Pipeline project – a 2000 km subsea pipeline that would stretch from Israel's gas deposits to Cyprus, Crete, mainland Greece and then across the Adriatic Sea to Italy.

Turkey is attempting to block the project, which may take years before it gets the go-ahead, with a maritime border agreement deal it signed with Libya last December. Turkey believes the deal extends its territorial waters as far west as the coast of Crete and Libya's maritime zone. However, the EMGF and other countries have denounced the Turkey-Libya agreement as void, as it ignores the criteria of the UN Convention on the Law of the Sea (UNCLOS).

More discoveries of gas in the East Mediterranean could instead bring about the construction of new LNG export facilities in Egypt or in Cyprus, rather than the EastMed. Shipments would likely head to a new FSRU planned for Alexandroupolis, Greece, in the northern Aegean.

From there, the gas would likely enter the Interconnector-Greece-Bulgaria (IGB) pipeline, which is due to start construction in the coming months with an initial capacity of 3 bcm/year. Gas delivered at this terminal could supply Greece, Bulgaria and other Balkan states. East Med LNG could also wind up at a new FSRU planned for Croatia and enter Southeast and Central Europe that way, spurring the wider use of gas for power generation.



The 2000 km EastMed Gas Pipeline project would stretch from Israel's gas deposits to Cyprus, Crete, mainland Greece and then across the Adriatic Sea to Italy

Energy management is coming home

Home Energy Management is becoming an increasingly important tool to energy suppliers and consumers, alike. **Junior Isles** reports on work that Delta-EE has undertaken which discusses the market and why the outlook is changing.

Home Energy Management (HEM) can mean different things to different people but energy research and consulting firm Delta-EE describes HEM as optimising energy flows in the home, e.g. helping a home to maximise electricity flows from say a solar PV installation. This might be where a HEM optimises PV generation by maximising the consumption of an electric hot water tank or space heating, or optimises time of consumption for large electrical appliances to take advantage of free electricity or special time-of-day tariffs.

It is an area that will grow in importance to both users and energy suppliers as technologies such as solar, batteries and electric vehicles become more common place in the changing energy market.

within the home but is more of a holistic view of the future and how we can manage and optimise electricity flows.

“In the future it will link to the electricity switchboard and smart meters; it will talk outside the home with the grid or the community, and will of course receive data from weather forecasts or electricity tariffs. We are at the start of the journey; other case studies will emerge and the complexity will continue to increase.”

Optimising the energy flows in the home is part of a wider trend towards a more distributed, democratised energy system. HEM can unlock value not only in the home but also in the community and the wider electricity system.

In the home it can optimise self-

starts settling on actual, rather than standard profiles.

Jouannic noted: “In some countries, such as in the Nordics, customers can already switch to dynamic tariffs but most of the time they will lose money because it is not managed carefully... but HEM can create benefits for them. Without HEM they will actually lose money.”

In the electricity system HEM can, for example, help network operators ease pressure on the networks by providing a form of demand side flexibility, while sometimes bringing benefits to the customer.

“The growing use of renewables has created issues in terms of grid frequency and the amount of electricity transmitted,” said Alix Weil, an analyst at Delta-EE that worked on the study. “HEM has the potential

to slowly move to include HEM in their offers.” Key companies in the community energy space include Germany’s Sonnen, which offers peer-to-peer trading within its national community, and a variety of software companies.

There are a plethora of players in the HEM market, with companies such as Schneider Electric, Legrand, GreenCom Networks, EDP, EDF Energy and Tesla Energy all offering products for certain segments of the market and different applications, and Delta-EE expects the number to grow, especially as companies in the EV sector roll-out products. “EV charge-point companies are largely missing but we imagine this will change in the next few years; we expect a lot of new offers to come from the EV angle,” said Jouannic.

Currently the most dynamic European markets for HEM, according to Delta-EE’s analysis are the Nordics and Germany. In building its analysis, the consultancy analysed the installed base and state of different HEM technologies, some of the key use cases, and different factors such as the electricity price and network charges, etc.

Weil explained: “What appeared very clearly is the fact that the Nordics are the most dynamic market for HEM. This is mainly due to the fact that there is a very high penetration of heating technology and very large EV base, especially in Norway. So this where we have the most units accessible for HEM, and therefore good potential.

“Germany is also well advanced due to the fact that there is already a lot of solar PV and batteries already available there. Due to the absence of net metering, there is a very high value for self-consumption and therefore for HEM.”

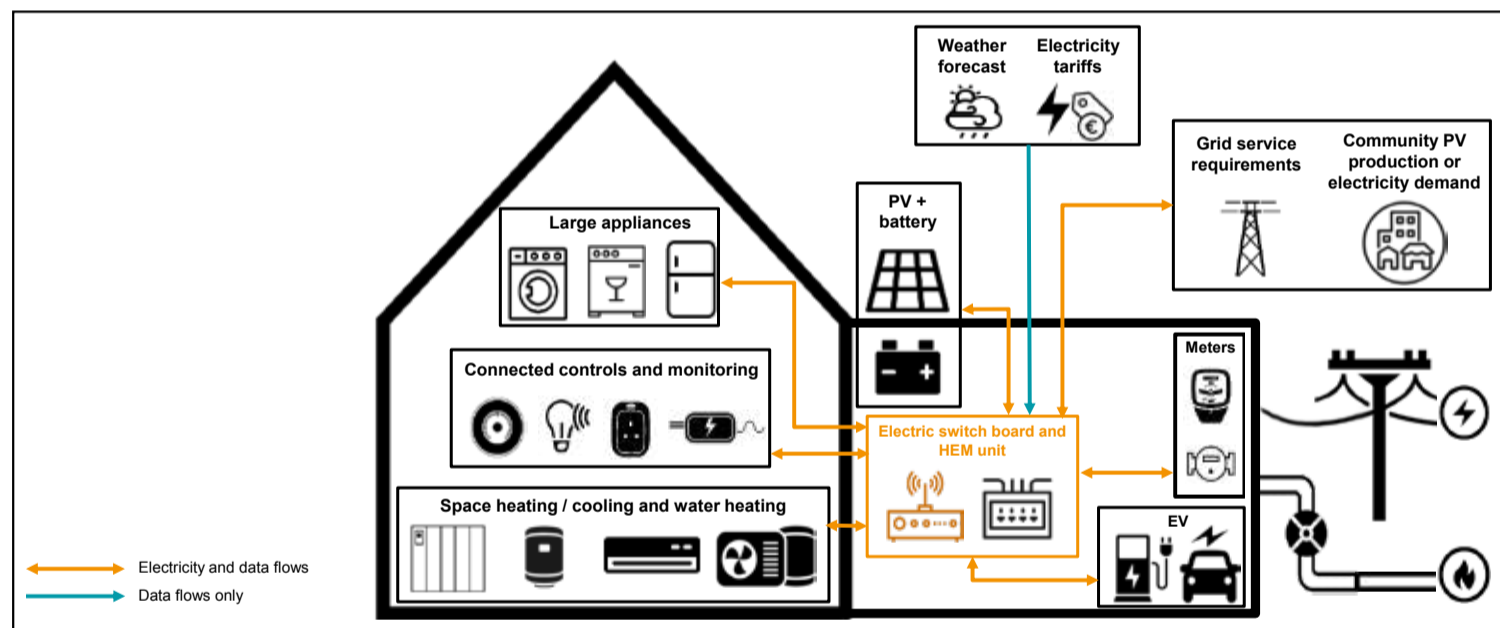
She said that other countries such as France, the UK, Italy and Spain also have interesting values in terms of specific loads but “their overall value for HEM is a little bit lower right now”.

Delta-EE estimates that the European HEM market will grow by an average of 25 per cent per year through 2023. There are several drivers, with the company pointing out that there are more than 20 million homes that have at least one large electric load to optimise.

Lopez also noted: “For example, in Europe, there is a very high penetration of electric heating or cooling, which presents opportunities for retrofit as opposed to new sales. These can be retrofitted with new switchboards to offer smarter control.

“The PV and battery markets are also expected to keep growing, especially as governments start to support self-consumption. We also see the uptake of EVs and therefore of EV charge-points at home. This will bring opportunities for HEM offerings.”

No doubt many companies see a great deal of potential for innovation in the area – from energy companies, manufacturers, software companies, connectivity specialists – and this will also continue to drive the market.



Home Energy Management is the dynamic and intelligent management of energy flows within the home

Delta-EE recently published a study that looks at the HEM market, its drivers and what to expect going forward.

Arthur Jouannic, who heads Delta-EE’s Paris office and is responsible for all the Home Energy Management research and was leader on the study, said: “The whole idea of HEM is not only simple use cases

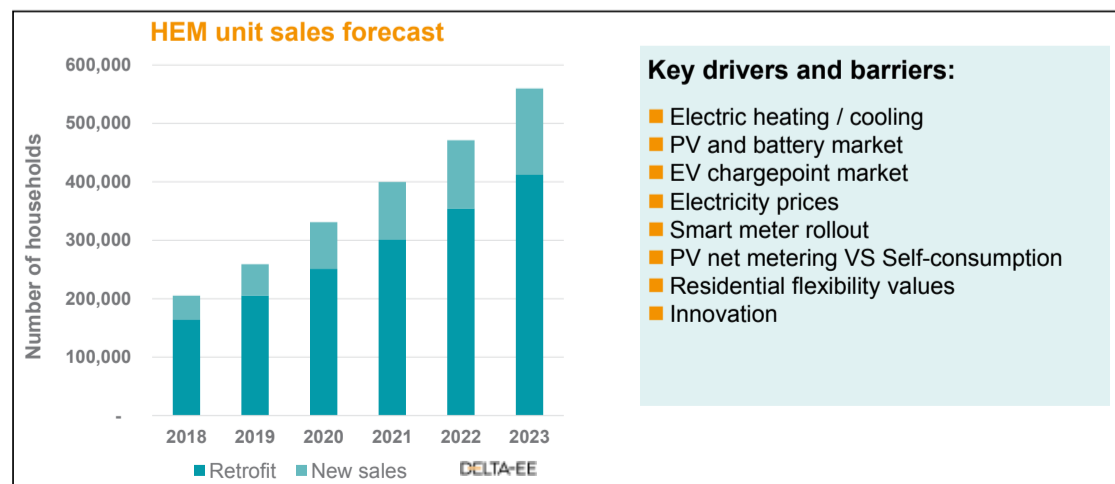
consumption as well as the time-of-use (TOU) tariff. This already provides a commonly accessed value stream and is therefore, according to Delta-EE, becoming “a hot topic from the customer perspective”. Delta-EE noted that these dynamic TOU tariffs will become increasingly widespread as smart meters are rolled out and the electricity system

to store electricity and sell it back to the grid at times of need. This is a great help to TSOs and DSOs (transmission system operators and distribution system operators). It is therefore of value to those with HEM, since this value can be sold [to the TSOs and DSOs] at a fixed price.”

Communities are an interesting area, although not yet fully exploited by HEM, according to Delta-EE. Communities are the gathering of households or buildings that are consuming and generating electricity and selling it to each other.

Ricardo Lopez, also an analyst at Delta-EE who worked on the study, explained: “The energy community is getting more and more attention because customers are attracted to the idea of consuming locally produced energy or by buying green energy generated by others like them. New business models are therefore emerging that enable peer-to-peer trading at either the national or local level. We think that HEM could optimise this and allow them to get more value.”

Weil added: “So far, no companies are doing HEM and peer-to-peer at the same time but we still see a lot of activity in the peer-to-peer sphere. We think that companies are going



With over 20 million homes having at least one large electric load to optimise, the European HEM market will grow by approximately 25 per cent per year

Strengthening the PV offer with batteries

Integrating solar PV and batteries is opening up novel possibilities. Mott MacDonald examines four examples that cover the main opportunities this combination of technologies can address, in each case providing an indicative scoring of the likely uptake. Oscar Velasco

The percentage of renewable energy (RE) in the global energy mix has increased significantly in recent years. Solar photovoltaic (PV) technology is leading this emergence, with large-scale grid-tied projects dominating in both developing and developed countries.

Success is due to the modularity of PV systems, which can be designed in capacities ranging from kilowatts to megawatts, and are simple to install, operate and maintain.

The steep reduction in project costs from component manufacturing, installation, operations and maintenance and other costs, are the main drivers for the rapid spread of PV technology globally.

Grid-tied PV systems are connected to the utility grid and have to supply

following four examples cover the main opportunities this combination of technologies can address.

In each case, we give an indicative scoring of the likely uptake based on a five-star rating, with a two-star score indicating a marginal case for deployment, while five-stars indicates a very attractive economic return.

■ **Application 1: Rural electrification in developing countries.** Much of Africa remains off-grid. Many national governments are not planning to expand their electrical networks into rural areas in the foreseeable future as low population density makes it hard to recoup the cost of investment.

Off-grid PV offers a solution. It can meet the needs of isolated homes, health centres and industries. PV with batteries can meet needs ranging from

typically high cost kerosene or batteries (used in lamps) or diesel generated electricity, the economics of solar with batteries is very attractive.

Rating: *****

■ **Application 2: Displacement of oil generation.** Developing countries use large quantities of heavy fuel oil and diesel to produce power. Costs vary by country and region, but it is expensive and polluting. Fuel savings can be achieved by reducing demand for heavy fuel oil and diesel-powered generation using PV and storage.

Solutions rely on tying the technologies together into a grid and providing energy management to balance the contributions of each energy source and load requirements.

Currently, PV can typically account

will make it technically feasible for countries to continue to increase PV penetration into their electrical networks.

The economics of adding batteries to manage ramping are significantly less strong for the owner of the generator, although on an overall system basis, this often provides a significant net benefit. The star rating depends on whether the generator can access the overall system benefits.

Rating: *** where benefits can be accessed; otherwise **

■ **Application 4: Capacity firming where grid connected.** Capacity firming enables PV plus storage to dispatch a committed power output over an extended time period, but much less than 24/7. Capacity firming is achieved



energy at a specified voltage and frequency. Grid operators have additional requirements such as reactive power control.

The main limitation of grid-tied PV is its dispatchability – the ability to supply power on demand. Steeply falling energy storage costs are helping PV operators respond to the challenge, countering weather-related intermittency to achieve a smoother energy output curve.

Batteries are competing in the electric vehicle (EV) market as well as bulk energy management, and integrating solar PV and batteries is opening up novel possibilities. The

1-10 W ‘pico’ systems for street lighting, for example, to domestic and community scale. When meeting the needs of several consumers, solutions will involve a distribution network and metering – so-called ‘micro-’ or ‘mini-grid’.

Advantages of off-grid applications include: ability to meet different load profiles; wide range of capacity from watts to megawatts; low cost of distribution due to the short distance between points of production and use; and ability to interconnect with diesel or hydro generation to achieve 24/7 power.

Given that the benchmark option is

for 10-15 per cent of energy intensive users baseload demand, and 20-25 per cent of energy demand for domestic dominated demand.

Hybrid PV-storage-diesel solutions are suitable for isolated heavy industries or villages that use diesel generators. With typical requirements from hundreds of kilowatts to tens of megawatts, shifting from diesel-only generation to hybrid solutions brings economic and environmental benefits, extending the diesel generator’s service life. Competing against diesel, the economics are strong. Even versus heavy fuel oil, such applications are attractive.

Rating: ***** versus diesel; and **** versus heavy fuel oil.

■ **Application 3: Managing PV ramp rates where grid connected.** In some countries, PV makes up such a large proportion of the energy mix that weather-related fluctuations in output can cause network instability and centrally controlled PV generation is often curtailed. Grid operators in Costa Rica and other countries have addressed this by requiring PV plants to ramp-up and ramp-down production on demand.

Grid-tied PV and batteries can comply with this ramp requirement. The PV inverter is set up to provide the ramp-up slope. Batteries can be deployed to prevent steep falls, thus providing the ramp-down slope. This does not require large storage – only equivalent to about 15 minutes of PV capacity is needed.

Adding storage to a PV system will increase the cost of the solution but

by storing a proportion of the energy generated from the PV array during peak sunlight hours, then exporting it to the grid after sundown or even retaining it for early morning, when irradiance is low.

Typically, this solution requires around three generating hours of storage. Committed power output will vary depending on the power purchase agreement (PPA); the PPA needs to provide an uplifted purchase price for delivering power outside of the peak daylight hour which is sufficient to make investment in additional PV capacity and storage worthwhile.

Rating: *** where the PPA provides the incentive.

The table summarises the main characteristics of solar and batteries in the four different applications. The indicative costs are in €/kWh and all relate to a megawatt scale application in an average African country.

Overall, we see investments in solar continuing. It is flexible, increasingly robust and in time can be linked with emerging technologies such as ‘green’ hydrogen – that is, hydrogen produced from water by electrolysis using renewable energy. By strengthening PV systems with batteries, the scale of installations will increase. In large power systems, we anticipate single projects touching 2-3 GW in capacity by 2030, calling for HVDC grid connections due to increasing distances from the power source.

Oscar Velasco is Solar Engineer at Mott MacDonald Limited.

Main characteristics of solar and batteries in the four different applications

Application	Main grid connected	Storage duration	Share of output	Output Profile	Economic attractiveness	Indicative cost €/kWh
Rural electrification	No	3-4 hours	70%	Load tracking	****	25-30
Displacement of oil generation on mini grid	No	15-30 mins	20-25%	Natural bell shape	*****	8-12
Managing PV ramp rates	Yes	15 mins	Not meaningful	Natural bell shape	***	8-12
Capacity firming	Yes	3-4 hours	Not Meaningful	Truncated bell shape	***	25-30

Technology

Making a sterling effort in energy storage

Dispatchable wind and solar, 24/7: an artist's rendering of Azelio's solution

New technology that combines thermal energy storage with Stirling engines is being developed to bring cost-efficient, 24/7, renewable power closer to commercialisation. Junior Isles explains.

Renewables plus storage, and in particular solar plus storage, is fast becoming a major disruptor technology in the electricity sector – whether as an off-grid solution for remote communities in developing countries or for owners in more developed markets looking to produce their own power and potentially sell excess electricity back to the grid.

Typically, these systems take the form of solar photovoltaic (PV) panels connected to batteries, usually lithium-ion. But while battery storage systems are cost-effective for providing a few hours of storage per day, they are not the ideal solution in scenarios where longer term storage is needed.

In September last year, Swedish solar energy company Azelio launched a partnership with Abu Dhabi Future Energy Company ('Masdar') and Khalifa University of Science and Technology to run a pilot project in Abu Dhabi that will evaluate a new technology in power storage. It is the second such pilot that is being built to officially verify this promising technology.

This latest pilot will be installed within the site of the Sustainable Bioenergy Research Consortium (SBRC) – a research centre located at the Masdar City campus of Khalifa University. Electricity generated from the installation will be used to power the air conditioning for the project's office and storage units.

The pilot aims to test and demonstrate Azelio's Stirling engine systems and integrated thermal energy storage (TES) solution for renewable energy projects that use solar PV, concentrated solar power (CSP) and

wind energy, or projects that provide off-grid solutions, with the purpose of determining if the technology can be included in current and future renewable energy projects.

Commenting on the drivers behind the technology's development, Jonas Eklind, Azelio's CEO, said: "The key driver for all our projects is that if you want storage that can provide you with renewable energy 24 hours a day, our technology is the most cost-efficient alternative."

"And the most unique thing is that we can build these 24 hr/day solutions in a distributed way, so you can have small-medium sized projects close to the end-user. Of course you can build 24 hr storage with stored hydropower but you need quite a big end-user. Ours is a solution for what you call distributed baseload, where projects are based on 100 kW modules that can provide electricity for 13 hours. Plants will be typically between 500 kW and 20 MW."

Typically, the system would comprise wind turbines or solar panels, an energy storage media and a Stirling engine for converting the heat from the storage media to electricity.

Eklind explained: "The heat storage is done at a very high temperature of 600°C. Firstly, this gives a very high energy density, for more cost-efficiency; and secondly it gives a high efficiency when you convert that heat back into electricity, since that efficiency very much depends on the temperature potential between the ambient temperature and the storage temperature."

Research and tests showed that an aluminium alloy, with a melting temperature of 577°C was the optimum material to use as the storage media. Eklind also explained that having a storage media that goes through a phase change, e.g. from solid to liquid, allows an even higher energy density. He added: "We have a maximum temperature in the system of 670°C. As we need to do this phase change at least one time every day for 30 years, we need a material that is not destroyed by the high temperature. Salt [as the energy storage media] could not survive such a high temperature. And even at a lower temperature, salt could not survive one phase change per day for 30 years."

Notably, the aluminium alloy is stored in a specially shaped container that not only accommodates the changing shape of the melting alloy but also maximises heat transfer from the electrical heating element into the block of alloy. Eklind also notes that one of the biggest innovations is in the energy transport within the system. "At the other end of the

system we have to transport the heat energy stored in the aluminium into our conversion unit, which is a Stirling engine."

The Stirling engine basically operates in a closed system, extracting the heat from the storage media to drive a piston that is connected to a generator to produce electricity.

Azelio has been working on the system for several years. It has been using its Stirling engine since 2008 and developed the thermal energy storage system in 2016. Eklind says the company has put all the components of the system together and is currently running a demonstration project in Sweden.

In addition to this, the first pilot plant is under way at the Noor solar complex in Morocco. In collaboration with Morocco's Agency for Sustainable Energy (Masen), the pilot aims to produce verification data under the more challenging ambient conditions in which it will typically operate.

"Operating in Morocco is different to Sweden," said Eklind. "There is different ambient temperature, there is a lot more sun and more heating up of enclosures and there is a lot more dust. The quality of the electrical output also has to be tested. In Sweden, there is no sun in the winter, so we are charging it with grid electricity, this quality will be different from the electricity produced from PV panels."

This pilot started operating at the end of December last year and Azelio is now optimising and tuning the system before starting a formal verification run that will be supervised by an external company. Data produced from this verification will be important in securing financing for future commercial projects. "For normal projects, you typically need 6-12 months of data," said Eklind.

Formal verification will start during the first quarter of this year to provide data which demonstrates that the system can, for example, be charged in the predicted time, contain the specified amount of energy, and discharge it in the predicted 13 hours at the specified power output.

It also needs to demonstrate the predicted operational availability. "We need to demonstrate that it has run as it should with only the need to stop it for normal service every 6000 hours," said Eklind. "It should also not need any special tuning or adjustments that requires specialists. Essentially it must run as a commercial or industrial project, that can be serviced by local people."

The pilot in Abu Dhabi is a second verification unit that will be started in the second quarter of this

year. Here Khalifa University will provide the research support and expertise needed for the two testing periods at the pilot and the data collected by the researchers during the testing phases will be compared with data from existing dispatchable technologies.

Following this, Azelio expects to start volume production of its units during the summer of 2021 and then start "more industrial deliveries" in the second half of that year.

There has already been significant interest from potential customers. In January Azelio signed a Memorandum of Understanding (MoU) with the Jordanian company Hussein Atieh & Sons Co. (HAE), to work together on setting up a small-scale project in Jordan.

The project paves the way for a commercial collaboration of about 25 MW of Azelio's energy storage technology in the Jordanian market until 2023. This capacity is forecasted to provide 50 kW in 2020, 3 MW in 2021, 7 MW in 2022 and 15 MW in 2023. The first project of 50 kW with 13 hours of storage will be installed in Q4 2020.

Eklind added: "We actually have MOUs for five projects that have specified timelines. These are MOUs for projects that have a request for deliveries of around 160 MW in total for the period of 2020-2024. These are in sub-Saharan Africa, Oman, Jordan and California. We also have MOUs with three companies for projects without specified timelines."

With agreements for expected delivery of small commercial installations this year, Azelio's system is essentially already a commercial offering. Verification data will allow these projects to secure financing and for the end customer to achieve financial closure.

Certainly the future looks promising, with potential customers already lining up. According to Eklind the company is currently evaluating a project pipeline with a value of €16 billion.

"When we presented the solution for the first time in June 2018, during that summer we received requests for more than 100 projects in 20-25 different countries," he said.

Eklind concluded: "The huge pipeline shows that the market is vast and that the technology can be used in so many different places... but at the same time we are directly replacing fossil fuels with dispatchable renewables. Being able to bring electricity 24 hours/day to regions that have no access to electricity at all has a big social impact. This makes working on such a development very rewarding."

Eklind: "... the most unique thing is that we can build these 24 hr/day solutions in a distributed way"





Junior Isles

More trees just won't cut it

US President Donald Trump may have been the most mentioned participant at the recent World Economic Forum (WEF) Annual Meeting in Davos, Switzerland, but he offered little in terms of his country's contribution to the battle against climate change.

While topics like geopolitics and cyber threats were among the top subjects of the week-long debates, the main discussions centred on climate change and the associated risks. Much of Trump's speech, however, was devoted to lauding his administration's domestic economic policies.

Clearly Trump—a long time climate change sceptic, who in the early days of his presidency dismissed it as a hoax created by the Chinese—either remains unchanged in his beliefs or puts his own domestic economy ahead of tackling what is by common consensus a global crisis.

Indeed in his Davos address the US president poured scorn on what he sees as pessimism and alarmist rhetoric from climate change activists and environmentalists.

"To embrace the possibilities of

tomorrow we must reject the perennial prophets of doom and their predictions of the apocalypse. They are the heirs of yesterday's foolish fortune tellers," he said, adding that those people "want to see us do badly". He compared such "alarmists" to the Cassandras of earlier decades who warned of over-population, "mass starvation," and the "end of oil".

"We will never let radical socialists destroy our economy, wreck our country..." he said. This begs the question: does Trump see "radical socialists" as a greater threat than climate change? Perhaps he knows something we do not, although I doubt it.

Trump said that with "US researchers and companies leading the way, we are on the threshold of virtually unlimited reserves of energy including from traditional fuels: LNG, clean coal, next generation nuclear power and gas hydrate technologies". Trump should note that such energy reserves are from unlimited and with the exception of nuclear, all emit carbon when burned. In fact, although a potentially valuable energy resource, gas hydrates release

large amounts of methane—an even more potent greenhouse gas than CO₂—when they decompose.

So apart from investing in "virtually unlimited reserves of energy", what's his plan? The only statement related to climate change that received applause from the audience was his commitment to the '1 Trillion Trees Initiative', a programme to protect and restore one trillion trees by 2050. Planting more trees is admirable; trees are nature's carbon-sink and efforts are needed from all directions. Yet it is hardly a strategy that Trump needs to announce with such fanfare. Putting it into perspective, 1 trillion trees is almost three times the amount of all the trees in the Amazon rain forest. Just finding space and physically planting that many trees is a tall order; and how much of an effect will they have? Equally critical, is how fast would they have an impact?

Trump would do better to clean up industries and their energy supplies, and redouble efforts in energy efficiency in both electricity supply and heat. Further, there is increasing evidence that investing in clean tech will not "wreck our economies". To the contrary, businesses see investing in clean and sustainable technology as crucial to addressing their future business challenges, of which risks linked to climate change rank as the greatest concern.

During the Davos meeting the WEF, in collaboration with Marsh & McLennan and Zurich Insurance Group, launched its 'Global Risk 2020 Report'. The report is part of the Global Risks Initiative, which brings stakeholders together to develop sustainable, integrated solutions to the world's most pressing challenges.

In compiling the report, over 750 global experts and decision-makers were asked to rank their biggest concerns in terms of likelihood and impact. For the first time in the survey's 10-year outlook, the top five global risks in terms of likelihood are all environmental.

The report sounds the alarm on: extreme weather events with major damage to property, infrastructure and loss of human life; failure of climate change mitigation and adaptation by governments and businesses; man-made environmental damage and disasters, including environmental crime, such as oil spills, and radioactive contamination; major biodiversity loss and ecosystem collapse (terrestrial or marine) with irreversible consequences for the environment, resulting in severely depleted resources for humankind as well as industries; and major natural disasters such as earthquakes, tsunamis, volcanic eruptions, and geomagnetic storms.

It adds that unless stakeholders adapt time will run out to address some of the most pressing economic, environmental and technological challenges. This signals where action by business and policy-makers is most needed.

John Drzik, Chairman of Marsh & McLennan Insights, said: "There is mounting pressure on companies—from investors, regulators, customers, and employees—to demonstrate their resilience to rising climate volatility."

Corporations appear to be embracing the changes needed to build sustainable, clean businesses—not just to gain PR points but because it makes business sense. The growing number of RE100 members and companies

achieving carbon neutrality is growing. RE100 is a global corporate leadership initiative bringing together influential businesses committed to 100 per cent renewable electricity.

Since it was launched at Climate Week NYC 2014, the initiative has expanded across Europe, North America, India, and China, and is now seeing rapid growth in areas such as Japan and Australia.

Led by The Climate Group in partnership with CDP, RE100's purpose is to accelerate change towards zero carbon grids, at global scale. Both The Climate Group and CDP are part of the We Mean Business coalition, working to catalyse business action and drive policy ambition to accelerate the zero-carbon transition.

According to the coalition, 1176 companies globally now recognise the transition to a zero-carbon economy is the only way to secure sustainable economic growth and prosperity for all. It says businesses are harnessing climate action as a driver of innovation, competitiveness, risk management and growth, while delivering the emissions reductions needed to avoid dangerous climate change.

With energy systems being the driver of economic growth, corporations are making the transition by committing to sourcing 100 per cent of their energy from renewables and increasing energy productivity.

Last month Visa announced it had reached its goal to use 100 per cent renewable electricity by 2020, while Japanese carmaker Toyota Motor Corp. said it successfully powered its European operations and facilities with 100 per cent renewable electricity in 2019. And in a blog post published during the week of the Davos meeting, Microsoft went one step further, pledging to become "carbon negative" by 2030. The \$1.2 trillion software giant said it would launch a \$1 billion innovation fund to tackle the climate crisis with new carbon reduction, removal and storage technology and said would offset all the carbon emissions it has produced since it was founded in 1975.

These announcements illustrate that clean energy and sustainability is not only essential to avoid irreversible climate change but is also big business.

In January research company BloombergNEF (BNEF) reported that a new record was set in 2019 for the volume of sustainable debt issued globally in any one year, with the total hitting \$465 billion globally, up from \$261.4 billion in 2018.

Jonas Rooze, lead sustainability analyst at BNEF, commented: "Our data show sustainable finance continuing to power ahead on a global basis. The steep increase is fuelled by end-investors' concerns about the threat of climate change, and the desire of many big company, bank and government leaders to be seen as behaving responsibly."

The path ahead, however, will not be easy. As Mathias Lelievre, CEO at Engie Impact, points out: "Companies are increasingly embracing the notion of sustainability transformation, but the challenge of achieving carbon reduction targets is highly complex—that's why according to Engie Impact analysis, only 25 per cent of companies are on pace to achieve their commitments."

Clearly the battle against climate change is no walk in the park, no matter how many trees are planted.

